The FOUNDRY

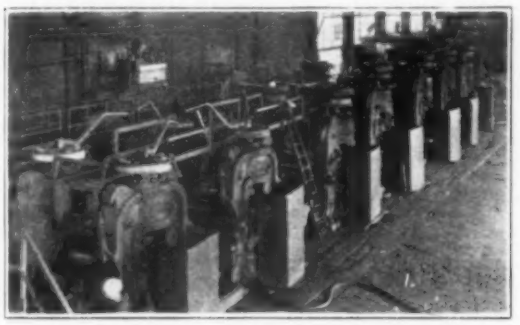
Volume 56
Number 10

Published
Semimonthly

CLEVELAND, OHIO, MAY 15, 1928

Castings Speed Production of Sheet Steel

FOR a number of years little change was noted in the accepted methods of manufacturing sheets. While other branches of the steel rolling mill industry continued to forge ahead with the application of power and mechanical equipment, the success of the process of rolling sheets remained a matter of personal skill and physical strength. However, the sheet manufacturing industry of the country today is passing through a period of remarkable development, due largely to the stimulus resulting from a rapidly growing market for that commodity. Mechanical equipment perfected and placed in operation during the past few years marks the greatest step made in improvement of methods of sheet manufacture since the art of rolling that product was taken from Saxony to Wales and later from Wales to the United States. The new process is continuous and produces sheets mechanically without the aid of manual labor, so essential in the generally accepted method. Production is increased greatly since one mill of the new type will roll as much sheet tonnage annually as 50 ordinary hot sheet mills. Other advantages also are claimed. Of course, a heavy tonnage of castings is required in the construction of the new continuous type mill, since seven stands of horizontal rolls and four stands of vertical rolls are used on the mechanical mill in the place of the two stands of 2-high rolls on the single sheet mill.



Seven Stand Jobbing Mill Which Produces Sheets Up to 16 Gage, 44 Inches Wide and 140 Inches Long

Find Where Castings Can Be Sold.

CONTENTS

SPECIAL ARTICLES

Page

Pushing Back the Jungle to Fill the World's Sweet Tooth—By Pat Dwyer 376
Business Men Co-Operate to Provide Industrial Training—By H. R. Packard 382
Barcelona Meeting Is Successful—By Vincent Delport 384
Expounds Principles of Successful Cupola Operation—III—By John W. Bolton 387
Electrochemists Discuss Problems Related to Electric Melting 390
Removing the Hazards from Piece Price Quoting—By O. C. Gilbert 392
Bill Touches Upon Some Molding Problems—V—By Pat Dwyer 397
Cleaning Room Progress Aids Production of Quality Castings—By Frank G. Steinebach 401

REGULAR DEPARTMENTS

How and Why in Brass Founding — By Charles Vickers 400
The Shakeout 406
Trade Trends in Tabloid 407
Comings and Goings of Foundrymen 408
What the Foundries Are Doing 414

—o—

PUBLISHED BY THE PENTON PUBLISHING CO., CLEVELAND, O.
BRANCH OFFICES

CHICAGO ..... 1147 Peoples Gas Bldg.
CINCINNATI ..... 209 Edwards Bldg.
NEW YORK ..... 2203-2206 No. 220 Broadway
PITTSBURGH ..... 2148-49 Oliver Bldg.
SAN FRANCISCO ..... 24 California Street
WASHINGTON, D. C. ..... 1653 Pennsylvania Avenue
BIRMINGHAM, ENGLAND ..... Prince's Chambers
LONDON, ENGLAND ..... 416-417 Caxton House, Westminster, S. W. 1
PARIS, FRANCE ..... No. 9 Rue de Londres
BERLIN, GERMANY ..... Wilhelmstrasse 114, Berlin SW, 48

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico ..... $3.00 a year
Canada ..... $4.00 a year
Great Britain and other Foreign Countries ..... £1:0:0 a year
Single copies ..... 25 cents

Copies published three months or more previous to date of current issue, 50 cents each

Member, Audit Bureau of Circulations, Associated Business Papers Inc., National Publishers' Association

The A. B. P. is a nonprofit organization whose members have pledged themselves to a working code of practice in which the interests of the men of American industry, trade and professions are placed first—a code demanding unbiased editorial pages, classified and verified paid subscribers, and honest advertising of dependable products

Copyright 1928 by the Penton Publishing Co.

Pushing E

By Pat Dwyer

Huge Machines Require Exacting Accuracy

Fig. 1 (Left)—More of the Jungle Is Cleared Every Year by Sugar Cane Planters Throughout the Torrid Zone. Fig. 2 (Right)—The Ox Team Has Crossed the Most Remote Frontier

RECENT shipment to a Spanish interest in the Phillipine Islands of a complete sugar factory installation in which the milling equipment alone aggregates 2000 tons gives some idea of the size of these units built by the Fulton Iron Works Co., St. Louis. Also, to any person interested in the subject it served to typify the enormous scale on which cane sugar now is produced in every country adjoining or close to the equator in a continuous belt around the earth. Taking advantage of climatic and geographical conditions sugar research men have been enabled to make the grand tour and investigate ripening progress and manufacturing processes continually for a year.

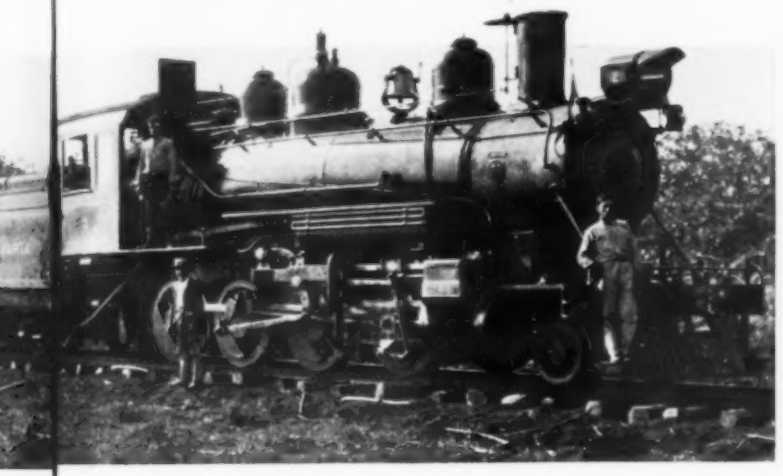
Fig. 3—Drag Mold for a Kettle, 10 Feet in Diameter, 5 Feet Deep Is Swept in a Sand Mold in a Pit in the Floor

With occasional fluctuation the world production of sugar has increased steadily. For the past six years the annual average amount has been in the vicinity of 25,000,000 tons. For the benefit of sticklers for accuracy the estimated production for 1927-1928 is given as 23,513,126 long tons. This total includes 7,659,608 tons of beet sugar. A great deal of interesting statistical juggling might be done with these figures, but the combined result probably would have no more effect on the mind of the reader than the plain statement that the world has an enormously developed sweet tooth.

Dipping for the moment into historical lore we find that the Chinese cultivated sugar cane and extracted the juice as far back as the fifth century of the Christian era. Sugar in a crude form was manufactured and some of it gradually

Back the Jungle to Fill *the World's Sweet Tooth*

filtered westward out of the jealously guarded flowery kingdom. As with the famous star of empire, sugar has held its way westward ever since. First to India and Persia, then to Egypt where the cane flourished under the benign influence of a semitropical climate and a liberal



application of fertilizing mud deposited by the retreating waters of the river Nile.

Spanish, Portugese and Venetian traders introduced sugar to one part of Europe. Crusaders returning to England from the holy land brought many tales of hunger and privation, of battle, murder and sudden death among the *paynim*. They brought curiosities from the natural and manufactured products of foreign lands and they brought sugar to whet the curiosity and taste of those who stayed at home. The crusades are but a memory. With one or two notable exceptions the names and deeds of the members of the gallant host have been forgotten, but the taste for sugar with which the inhabitants of the British Isles were inoculated has grown stronger with the years. The army of men engaged today in various parts of the earth in the cultivation, manufacture and transportation of sugar consumed in this one section of the world is greater than the combined army of enthusiasts who engaged in the various crusades.

Spaniards introduced sugar cane to Cuba, to Central America and to the Phillipines. The French developed the sugar industry in Louisiana. With its introduction into the Hawaiian islands about the middle of the past century the world embracing tour was finished. The industry no longer could spread out toward the west, but it could and did expand to an astonishing extent over the territory already partly occupied. More land continually has been brought under cultivation. Improved methods have increased the yield.

Mechanical equipment has kept pace with improvement in methods. In the first crude mill the cane was crushed between two wood rollers erected vertically and actuated by oxen walking in a circle. The recovery of juice was meager in proportion to the amount of material passed through the rolls. In modern mills typified by that recently shipped by the Fulton Iron Works Co., the cane is passed through a succession of rollers that extract the last vestige of moisture.

The first mill did not tax the capacity of one ox to keep it in motion. The latest mill and crusher are driven by three engines aggregating 3000 horsepower. The installation is 150 feet in length, 45 feet wide and 30 feet high. Where the old time primitive mill was capable of handling a few hundred pounds of cane per day, this modern giant will grind 5000 tons and recover sufficient juice to make 500 tons of sugar. The season only lasts a short time in any given locality, but when the mills work, they work fast!

Fig. 4—Long Bolts Attached to Two Pairs of I-beams on the Cope Support the Sand. Coke Fires are Employed to Dry the Cores

Fig. 5—Sand Forming the Core in a Kettle Casting Only Is Rammed to a Thickness of 8 to 10 Inches. Iron Rings Placed at Various Heights Furnish the Necessary Reinforcement

The Fulton Iron Works Co., organized in 1852, is one of the oldest if not actually the oldest firm in the United States engaged in the manufacture of cane sugar mill machinery. It has been a designer as well as a builder and many of the improvements incorporated in the mills from year to year first took tangible form in the drafting room of this company. Several years ago the business was moved to a large new plant in the northwestern industrial section of St. Louis. In addition to sugar mill machinery, the company builds special equipment for the chemical industry and is one of the pioneer builders of diesel engines on a large scale in the United States. The pattern shop, pattern storage, machine, erection and testing shops present many features of interest, but the present description is confined to the foundry.

Production Varies

The foundry building of brick and steel construction, 110 x 420 feet was designed for a normal output of 60 to 70 tons per day. In periods of depression production has fallen considerably below this figure, but at various periods the normal output has been exceeded to a considerable extent. At the height of the sugar boom, shortly after the war, the daily heats in the foundry ran close to an average of 150 tons.

Nearly all the castings made in this foundry are of a bulky character and are molded in pits in the floor. Rolls constitute an exception to this rule. They are segregated in a section of the foundry near one end and are molded in circular, split, iron flasks. Detail of methods and equipment will be taken up later. Many of the general characteristics may be noted in the many illustrations.

In addition to the main bay of the foundry 75 feet wide and extending the entire length of the building, a side bay 35 feet in width, paralleling the main bay for its entire length is devoted to several activities. It is divided roughly into three sections. Small castings are made in green sand molds in one section. The core-making department occupies a second section and the space between the two is occupied by the cupolas and accessory equipment enclosed by brick walls.

The wall at one end of the shop ceases at the crane runway, thus permitting the passage of one of the cranes to and from the yard where flasks, sand and other miscellaneous equipment are kept when not actually in use. Sand is taken inside and stored against the end wall with suitable partitions to keep the various grades apart. Mechanical equipment for preparing the facing and core sand is located close to the sand storage. Facing sand is prepared in a muller type machine made by the National Engineering Co., Chicago. Most of the core sand is mixed in a paddle type machine made by the Blystone Co., Cambridge Springs, Pa.

Use Many Cranes

On account of the bulky and heavy character of most of the castings and molds handled in this foundry, the crane service is unusually complete. The main bay of the shop is spanned by one 20-ton crane made by the Harnischfeger Corp., Milwaukee, one 20-ton and one 30-ton crane made by the Whiting Corp., Harvey, Ill. One of the odd features of these cranes is that the operator's cab is suspended from the center of the bridge, instead of under one end as in the usual installation. These three cranes are supplemented by two 5-ton side wall cranes made by the Harnischfeger Corp., mounted on tracks below the main traveling cranes and on the wall opposite the cupolas.

Small jib cranes attached to several pillars that separate the molding floor from that on which the cores are made, are utilized to swing cores from one department to the other. Several pits are located in this vicinity and

Fig. 6—Cores Are Made in a Wide Variety of Sizes and Shapes. The Core in the Lower Right Corner Is for a Diesel Engine Cylinder Head and Involves Some Intricate Venting Features

Fig. 7—Crusher Rolls for the Mills Are Cast Straight and Plain. Rows of Teeth Arranged in Spiral Formation Afterward Are Cut on Them

in many instances these jib cranes are employed to serve the pits in many ways where the load is not large enough to engage the service of one of the traveling cranes. For example one of the jib cranes may be employed steadily for several hours placing a set of dry sand cores in a large mold. Manifestly one of the main traveling cranes could not be held for such a length of time in one place. The coreroom is served by a 5-ton traveling crane.

Two 10-ton cranes, one made by the Harnischfeger Corp., and one by the Whiting Corp., are employed in the stockyard to unload materials, break scrap and convey the materials for the cupola charge to the platform. Most of the loads are handled by magnets. Even the drop ball for breaking large pieces of scrap is lifted and released by one of these handy devices.

Coke, limestone and iron are first deposited on an extension to the charging floor projecting into the yard. Here the material is loaded into three-wheel buggies and pushed by hand upon a scale where minor discrepancies in weight are adjusted. Each buggy then is pushed close to the opening in the cupola. An air hoist is hooked to the back end and as the back goes up, the charge slides through the open end of the buggy into the cupola. The charging floor is formed of smooth steel plate. The single, front wheel of the buggy is pivoted and it is stated that only a small crew is required to handle the charge for comparatively heavy heats.

Before leaving this section it may be pertinent to note that two cupolas are located close together and are designed to be served from the same platform. On occasion, as mentioned elsewhere, both cupolas may be used simultaneously, but under normal conditions, only one is employed to melt iron for the daily heat. One is lined to 72 inches and the other to 66 inches. Both were supplied by the Whiting Corp., Harvey, Ill. Blast is furnished by blowers of the positive pressure type made by P. H. & F. M. Roots Co., Connersville, Ind.

Small, conical slag pots suspended from a conveyor catch the slag as it pours from the back of the cupola

Fig. 8—Partial View of the Stockyard Where Steel Gears and Steel Shafting Are Stored. Cast Iron Centers for the Gears Are Made in the Company's Own Foundry. Fig. 9—Pig Iron, Scrap and Coke Are Stored in a Stockyard Extending the Full Length of the Foundry. Materials for the Day's Heat Are Loaded on an Extension to the Charging Platform

Fig. 10—Castings Are Transported from the Foundry into the Cleaning Yard and Machine Shop on Stout Steel Buggies Running on a Double Track Industrial Railroad

and are used to convey it to a point outside the cupola building where the solidified lumps of slag are dumped for final removal. This method is considered quite an improvement over that employed where the slag from the entire heat is allowed to accumulate in a pile immediately back of the cupola. Initial removal of the slag facilitates dropping the bottom and the subsequent examination and disposition of the material, coke, iron and sand.

One more crane remains on the list. This is a 20-ton crane, 50-foot span, made by the Whiting Corp., and operating over the yard space where the castings are cleaned between the foundry and machine shop. Climatic conditions in the St. Louis district favor a type of cleaning department that is not feasible in other and less favored localities. Castings are cleaned in the yard as shown in the accompanying illustration.

A narrow-gage, double, industrial track connects the various departments and facilitates the passage of patterns between the pattern shop and foundry, also the passage of castings into the machine shop either from the foundry direct or from the cleaning yard between the two buildings.

At one time loam molding was practiced extensively in this foundry. In recent years the practice has been abandoned entirely in favor of sand molds either dried in the floor or in a large oven provided for the purpose at the end of the coreroom near the cupola. Three ovens for drying the cores are located in the same general vicinity. Each oven is coke fired from the outside end. The heat from the fire is drawn through a tunnel under the center of the floor and rises through a great number of small openings in the roof of this tunnel. A cable reeved through a sheave anchored in the floor, one end hooked to the car and one end looped over the crane hook, is employed for hauling each car into and out of the oven.

A partial idea of the wide range of cores handled may be had from the illustration Fig. 6 showing a general view of the coreroom from the end where the ovens are located. Hardly any two are alike and the same relative condition would be shown at any season of any year. Cane mills and installations for other industrial purposes are not built at the rate of several thousand per day. Each one presents an individual problem with numerous changes from those that have gone before. Sometimes the change is suggested by the customer and again it is proposed by the designer to meet special conditions. The net result is the same. Patternmakers are kept busy making new and changing old patterns. A high degree of skill is required on the part of the coremakers engaged in this work since it is out of the question to supply the style of standardized methods and equipment employed, for example, in foundries engaged in the production of large quantities of duplicate castings.

Fig. 12—Rolls Are Molded in Circular Iron Flasks Split Vertically

General features connected with the molding of a kettle for chemical installation are shown in the illustrations Figs. 3, 4 and 5. The only pattern work required on this job is a pair of short sweeps. The remain-

Fig. 11—A Considerable Amount of Room Is Saved in the Foundry by Cleaning the Castings Outside in a Yard Spanned by a Crane

ing equipment, flask, arbors, spindle and spindle seat are standard and are used for a wide range of castings.

After the spindle, arm and sweep were adjusted properly the drag flask was leveled at a height that would bring the joint of the mold flush with the upper flange. A flask used in this manner serves for a curbing and also furnishes a more satisfactory support for the cope, than sand alone. A pattern ring the approximate size of the proposed casting was set in place and the space on the bottom and also between the ring and the flask was rammed full of sand. The first sweep then was employed to form a cavity corresponding to the inside shape of the casting. The surface was finished smoothly and covered with paper tacked in place. The spindle and sweep were removed and a suitable arbor was lowered into place to carry the sand in the core. Sand was rammed to the top of the arbor, or a little above the line where the curved bottom merged into the straight side.

Follow Improved Method

From this point, the procedure differed from that usually employed. Instead of filling the entire space with sand, a number of rings were built up as may be noted in Fig. 5 and the space between the rings and the mold (which in this instance corresponded to a pattern) was rammed full of sand. The rings were made in halves and were provided with short chucks spaced about 6 inches apart to reinforce the sand wall. An iron ring the proper diameter was employed as a base against which to ram the sand. It was drawn up several times as the ramming progressed and finally was removed before the cope was lowered into place.

Four long bolts attached to loops in the arbor were employed to attach the arbor and consequently the core to the cope. Two pairs of I-beams on top of the cope served as suspension beams for the bolts. Six risers were spaced on top of the flange as nearly to an equal distance apart as the bars in the cope would allow. Four 1-inch pop gates were set up on two diametrically opposite sides. The cope then was filled with sand, rammed in the usual manner, lifted off and placed on high stands as shown in Fig. 4 for finishing and drying. The drying was accomplished by several small coke stoves and was greatly facilitated by the fact that the core was only a shell instead of being solid. Sheets of corrugated iron erected all around the cope confined the heat to the face of the core.

To form the drag face of the mold, the spindle was returned to place and the second sweep was attached to the arm. The cutting edge of this sweep conformed to the outside contour of the casting. The sweep was attached to the arm in such a manner that it removed a thickness of sand corresponding to the required thickness of the casting. The face of the mold then was blacked and four coke stoves were suspended from long bars resting on a row of bricks on the joint face. These bricks also supported a number of sheets of corrugated iron designed to conserve the heat from the stoves and direct it to the sand forming the mold face.

Typical flask, pattern and equipment for making a roll casting are shown in Fig. 12. The pattern is comparatively short and is drawn up to any desired length. The flasks are parted in the center vertically for convenience in stripping them from the casting. A continuous vertical pocket at one side accommodates a long runner extending from the top to a tangential gate cut in the sand near the bottom of the casting.

Some of the smaller roll castings are poured through a ring of small rectangular pop gates set close to the center core and fed from a basin that is formed before the cope is removed from the mold. This runner basin is dried the same as the remainder of the mold. The lightning core in the center of the casting is made in halves, dried and afterward pasted and wired together.

Steel is used extensively in the cupola charges for nearly all the castings made in this foundry. Composition of the charges and analysis of the iron vary to a considerable extent since some of the castings are only ½-inch thick, while others may be 10 inches in thickness. With some exceptions for peculiar castings, the general aim is to produce an iron of high tensile and wearing quality and still be suitable under machining operations.

Progress Depends on Science

In his recent presidential address before the British Institute of Metals, Dr. Walter Rosenhain, National Physical laboratory, endeavored to bring about an understanding between the viewpoints of the research worker and the practical man. He stated that the function of the institute is to promote an interchange of ideas and experience between those engaged in the two activities and who are interested in the same subject. Much research work is of a highly scientific nature that cannot be understood readily by the practical man, but progress in the metallurgy of ferrous and nonferrous metals largely is due to scientific work, and a large field of research and discussion is open which should be common ground.

Dr. Rosenhain then explained the value of the equilibrium diagram and said that this formidable term simply represented those conditions which alloys tended to assume if they were allowed to attain their final condition of balance. The close correlation between microstructure and physical properties made it possible to conduct study in the microstructure of a new alloy and determine the physical properties at points where the microstructure indicated good results would be obtained. He also described the method of determining solid-solubility lines and said that although these determinations at first sight appeared only to yield results of an academic interest, they furnished the explanation of age-hardening of duraluminum and other aluminum alloys.

What Safety Can Do

S. M. Lippincott, secretary, Erie Safety council, Erie, Pa., in pointing out the value of safety first in industrial plants states that the gray iron foundry of the Erie City Iron Works, Erie, Pa., offers a splendid example of what may be accomplished. This plant was built in 1889 and during the 39 years of its existence not one man has been killed nor has one been maimed for life.

For over two years the foundry has operated without a single lost-time accident. A lost time accident is one that causes the injured person to lose time beyond the day of injury. Four slight accidents have occurred that required the first-aid treatment by the plant nurse, but no injury has required the care of a doctor. This record is due to the watchfulness of the men and the interest taken by the management of the firm. J. E. Maher, foundry superintendent, continually is alert to see that his men use the proper safeguards. Goggles are worn where needed, leggings protect the men from splashing metal, and the proper type of shoes are worn.

Sign Should Be Changed

On page 295 of J. W. Bolton's article in the April 15 issue of THE FOUNDRY, the second equation in the middle column should be

$C + CO_2 = 2\ CO$ minus heat (29,160 gram cal. per mol.). Carbon plus carbon dioxide changes to carbon monoxide minus heat.

Business Men Co-operate to
Provide Industrial Training

How the East Chicago Chamber of Commerce Has Set Up a Working Organization to Supply Apprentice Education

By H. R. Packard
(Secretary-Manager, E. Chicago, Ind.)

JUST about a year ago the East Chicago chamber of commerce, East Chicago, Ind., realizing the importance of an industrial training activity, directed its attention to the evolution of an adequate plan for its industries. A year of intense preliminary research work followed. A committee of the industrial division studied the needs and gathered reams of information. The experiences of other communities, though limited in number, were drawn upon. It was discovered that the community plan for training the skilled personnel necessary to the industrial well being of the community not only was feasible, but that it had been proved a success in other districts.

With the beginning of the current year, paper programs were translated into realities. At the present time 85 indentured apprentices are at work learning the essentials of their respective trades and attending school one-half day per week for the related or technical training.

After much deliberation this continuation plan was decided upon as being the most practical and best suited to local conditions. Apprentices are indentured to individual plants and are schooled through the essential operations of their trade at actual shop work. This portion of the plan is continuous and is distinctly different from the co-operative plan, whereby apprentices work and attend school generally through alternate two-week periods.

The only exception to their continuous employment in the industry to which they are apprenticed is one-half day per week which is set aside for their classroom instruction and training. During this period, for which they are paid at the going apprentice rate, they attend the Washington High school in a class set aside for their particular needs. This is being conducted under the auspices of the vocational educational department of the local school system.

Thus the two essentials of modern trade training adequately are met. The manual or craft portion of their training is provided for by detailed schedules of shop work covering all essential operations of their trade. The educational phases of the trade work, which cannot be provided on the job, are supplied by actual classroom study. In general this covers the following four main divisions: English; mathematics adapted to the trade; technical or related studies; and finally a general division including shop economics, safety, hygiene, etc.

The administration of this program under the auspices of the chamber of commerce has been directed by an advisory committee, whose personnel consists of representatives from each participating plant and the local schools. The advisory committee has four sub-committees under its general jurisdiction. The policies and general direction of the program rests with the main committee. School methods, shop schedules, administration details, and wage scales are represented by separate sub-committees.

Where Shops Function

The apprenticeship administration committee designs and deals with the administration of training programs, not only within individual plants, but also as regards the community program where such details are common to all plants.

The school methods committee is the link between the industries and the local school organization. For example, it provides displays of all materials and equipment giving shop atmosphere and background so necessary to the conduct of the school portion of this plan.

The shop schedule committee provides an organization to assure adequate shop schedules. Wherever complete programs are impossible in any one plant, owing either to a lack of diversity or quantity of production and manufacturing operation, this committee can arrange for an interchange of apprentice to the end that adequate shop schedules can be presented to every apprentice. Thus, if a smaller establishment in the community finds it impossible to provide a complete program of shop work essential to the trade in question, apprentices from this plant can be loaned or farmed out to a larger establishment in the community where the remaining shop work can be provided.

The wage scales committee has general jurisdiction over apprentices' rates of pay. Obviously it is essential to the successful conduct of a program of this kind that all establishments pay the same rate in any given trade. Revisions of these schedules whenever necessary are handled by this committee.

These groups have been functioning since the first of the year and have provided excellent administration of this program. All apprentices are interviewed through the apprentice training department of the chamber of commerce. A complete and adequate file is provided for this purpose at the chamber of commerce. As apprentices are required in the industries they are sent from the chamber of commerce and the necessary changes in its files are made. The routine machinery to arrange the school portion of the program between the industries and schools, the parents of the apprentices and the chamber of commerce, has been set up by the apprenticeship administration committee. All forms have been reduced to the minimum necessary for such training, so that the flow of apprentices from the community, through the chamber of commerce to the industries and into the schools goes on smoothly and quietly.

The following order of studies for a machinist apprentice is the detailed schedule for the four hours of classroom work:

1 hour safety, health, hygiene, economics and English.
1 hour mechanical drawing and shop sketching.
1 hour related mathematics.
1 hour reading related to the occupation.

This is supplemented by lectures, in-

spection trips, classroom display of shop materials and equipment, and enlarged or embellished courses of study.

Shop sketching, for example, to refer to the latter instance, is enlarged upon by the study of actual castings suitable for the purpose in the classroom. Thus apprentices not only are spending some portion of their time at mechanical drawing but, what is far more important, at actual shop sketching. A classroom display of all essential shop materials and equipment has been set up in the classroom where the 85 apprentices attend school in five groups distributed over five afternoons each week.

Co-relating Trades

Lectures centering around special manufacturing operations or outstanding technical branches familiar to the locality supplement the actual class work as provided for by the order of studies mentioned. A few of the 200 hours per year which each apprentice must spend in the classroom are used for inspection trips to plants in this and neighboring communities, but here again a definite program has been arranged, to the end that inspection trips become more than merely sight-seeing tours. Reports covering these trips are required from each apprentice.

Unless adequate schedules of shop work comprising the essential operation of each trade are provided in any apprentice training program, it must of necessity fail sooner or later. To insure this in the East Chicago plan, ideal schedules for each trade were prepared in turn. Each participating plant next prepared for those trades the schedule of operations best suited and possible to its own manufacturing operations. These schedules were then compared with the ideal to insure that no larger discrepancies might creep into any individual plant program.

However, where it has been impossible for an individual plant, owing either to its lack of diversity or quantity of manufacturing operations, to conform quite closely to the ideal schedule, interchange of apprentices has been agreed upon.

The apprentices are paid at a rate which insures the possibility of supporting and maintaining themselves upon entering their apprenticeship. This schedule of rates increases every six months or approximately every 1200 hours, until at the end of the four years of training the apprentice is receiving about 75 per cent of a mechanic's rate. Changes in these schedules, which differ slightly for the various trades, can be made only under the direction of the wage scale committee, whenever such revisions are necessary.

This plan of training is designed to meet the needs of young men leaving school, for whatever reason, either grade school, high school, or college. The minimum requirement which has been set is a grade school education. A boy leaving grade school and entering an apprenticeship must spend four years in trade training. A young man who has completed high school is given one year's credit and will therefore complete the same shop schedule in three years. A college graduate must devote two years to the same program. The young men in the community are encouraged to continue their formal school education as long as possible. Many high school graduates are at present serving apprenticeships and it is hoped that in the course of time the numbers can be increased. However, the program both as regards shop and related school work has been prepared to meet the needs of these three classes.

Studies Adapted to Trade

The related school portion of this apprentice training is entirely on an individual basis. Each apprentice pursues a course of studies fitted and adapted to the trade he has entered and he proceeds at his own pace unhampered and unhurried by any other apprentice in the community. Instruction is devoted entirely to assistance and guidance for the individual. This is necessary, not only because of the varied previous educational experience of individual apprentices, but also because apprentices must necessarily be inducted at any and all times throughout the year. The apprentice is given four hours per week on the employer's time to pursue the technical essentials of his trade. However, he is required to spend an equal amount of time in home study work. Class supervision and direction of the school program insures the fulfillment of these requirements.

All of the essential factors in this program are incorporated into an apprentice indenture or agreement to to which the employer and the apprentice, with his parents or guardians, are parties. The indenture sets forth in detail the shop and school schedules, as well as the rates of pay according to which the apprentice will work throughout his term of training. The employer agrees to provide employment approximately according to this schedule and the apprentice is assured of employment regardless of business conditions, except of course in the case of complete cessation of operations. The apprentice and his parents in turn agree that he is to remain in training throughout the term specified.

However, the apprentice indenture is not the sole link connecting the various interested parties. Each month the apprentice and his parents receive a report card setting forth in detail the shop and school grades attained during the past month. Parents are interviewed with the young applicant, either at the chamber of commerce or at the plant to which the apprentice has been sent.

Publicity Provided

Eighty-five apprentices to date are attending the local Washington High school for the one-half day classroom portion of their training. Approximately 125 are working as apprentices in the eight manufacturing establishments participating in this program at present. The discrepancy between those figures results from the fact that some apprentices who were previously employed at the plants in question had progressed to the point in their term of training where it was thought inadvisable to arrange for the related classroom instruction. More than 115 applications are on file in the chamber of commerce.

Informative programs through the schools, parent-teacher associations and civic and social organizations in the community are presenting to the civic body the tremendous advantages of such an educational program. Young men now can pass directly from school, whether it be from grammar school, high school, or college, into major or basic industries in an intelligent manner.

Gives Steel Creep

Recently the bureau of standards published a bulletin on the creep in five steels at different temperatures, by H. J. French, H. C. Cross and A. A. Peterson. This bulletin is Technologic Paper No. 362 of the bureau and gives the relations between stress, temperature, elongation and time for each of the five steels at temperatures within the range 70 to 1350 degrees Fahr. The price of the bulletin is 15 cents and may be from the government printing office.

The Stuebing Cowan Co., Cincinnati, and Holyoke, Mass., has moved its New England plant into larger quarters. The increase in floor space now permits the Holyoke factory to supply equipment for the eastern section of the country.

Fig. 1—The Opening Meeting Was Attended by the Officials and Delegates to the Barcelona Congress Representing Many Nations

Barcelona Meeting Is Successful

By Vincent Delport
(European Manager, The Foundry)

VISITORS from nine countries received a courteous and pleasant welcome from the organizers of the foundry convention that was held from April 11 to 14 in Barcelona, Spain. The convention was arranged by the Union Industrial Metallurgicas, Barcelona, under the patronage of the Spanish minister of labor and the International Committee of Foundry Associations. The main body of visitors arrived in the afternoon of April 10 and were received at the station by an official delegation headed by Cesar Serrano, representing the minister of labor, and J. de Miquel, president, Union Industrial Metallurgicas, assisted by J. M. Espana, vice president for Spain of the Association Technique de Fonderie de Paris, who managed the arrangements for the foreign delegates. The opening meeting was held on the morning of April 11, in one of the completed buildings which are being erected for the international exhibition to be held in Barcelona next year. The chairman was General Barrera, governor of the province, and Jose Serrat Bonastre, vice president, Union Industrial Metallurgicas, delivered a speech of welcome in which he emphasized the fact that this was the first occasion on which such an important foundry meeting was held in Spain. He said that the number of foundrymen present, who came from the four corners of Europe, was a proof of the efficacy of such meetings whose value lies in the exchange of knowledge and the co-operation between men in the same industry. Following the address, the head of each foreign delegation replied in the name of his country men: V. C. Faulkner, past president, Institute of British Foundrymen, for Great Britain; Ivan Lamoureux, vice president, Association Technique de Fonderie de Belgique for Belgium; Herr Geilenkirchen, director, Verein Deutscher Eisengiessereien, for Germany; H. Magdalenat, vice president, Association Technique de Fonderie de Paris, for France; Doctor Dresden for Holland; Com. Ing. Carlo Vanzetti for Italy, and Prof. Pisek for Czecho-Slovakia. V. Delport, European member of the committee on international relations, American Foundrymen's association, read a cable of greetings from S. W. Utley, president of the association. Cesar Serrano, who represented the Spanish government and is president of the Spanish permanent committee of testing materials, then addressed the congress, saying that a glorious page was being added to the industrial history of Spain, thanks to the presence of such a number of representatives of the foundry industry of the principal nations. He ended by reading telegrams of geetings sent by the king of Spain and General Primo de Rivera, head of the government.

General Barrera then formally declared the meeting open and the visitors were conducted to the exhibition, which had been organized in connection with the convention. The exhibits mainly were composed of raw materials obtained in Spain and castings manufactured in Spanish foundries. In addition, some foundry machinery and equipment supplied by some leading firms was shown. Hijo de Miguel, Mateu, exhibited grinding machines and wheels of American manufacture. J. Palau Ribes, Barcelona, showed grinding wheels manufactured in Germany. The firm of Siemens-Shuckert, Germany, exhibited electric trucks for transportation in the foundry. A complete sandblast machine with rotary table was shown by Etablissements Sisson-Lehmann, Charleville, France. Anglo-Espanola de Electricidad, S. A., had a display of furnaces. Maquinaria Anglo-Americana, Barcelona, showed grinding wheels of American and

Canadian manufacture. Fenwick Freres, Paris, showed its hoists and grinding machines, a sand riddle and a display of American hoists. A hardness testing machine was exhibited by C. Lana Sarrate, Barcelona. Badische Maschinenfabrik, Durlach, Germany, displayed some of its foundry equipment, including a heavy-duty molding machine. Urbano Eggenberger, Bilbao, also showed foundry machinery, including a molding machine and a sand-mixing and preparing machine in operation.

The first technical session was held on the morning of April 12, and was

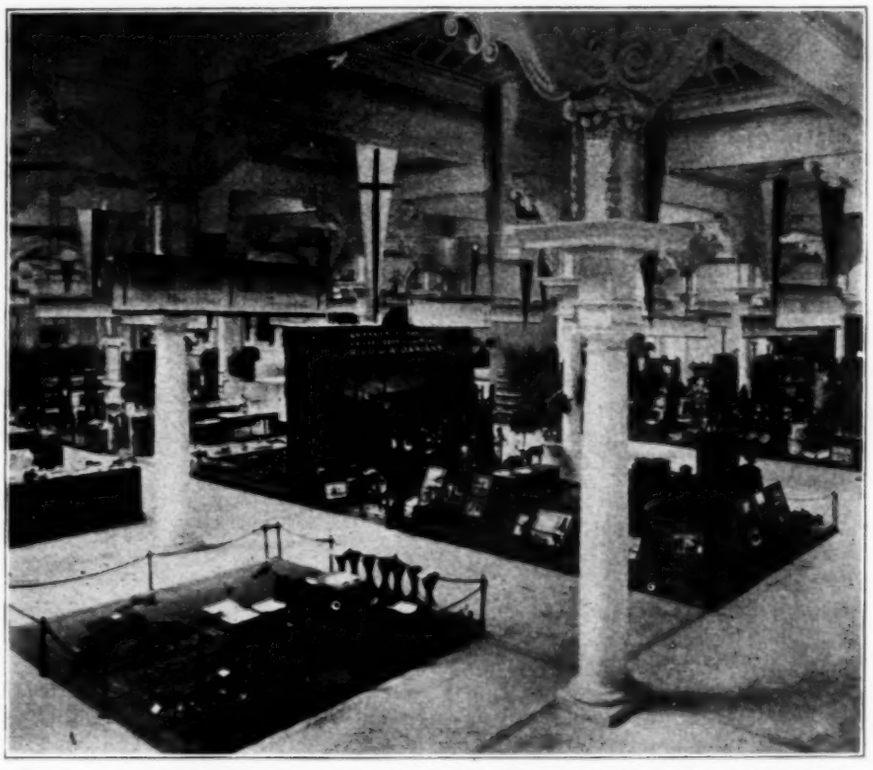


Fig. 2—The Exhibition Was Held in a Newly Completed Building Erected for the Barcelona Fair Which Will Be Held Next Year

divided into three parts. J. M. Espana presided during the first part and the proceedings opened with a paper by Joaquin Ferrer, Maquinista y Fundaciones del Ebro, S. A., Zaragoza, entitled "The Thermic Balance in the Modern Cupola." The discussion was opened by Dr. Dresden, the Dutch delegate, who pointed out that when the heat of the metal in the cupola reaches 1600 degrees Cent., the loss of heat corresponds to that temperature. Ivan Lamoureux, Liege, Belgium, referring to the additional row of tuyeres now seen on certain modern cupolas, said that the use of these tuyeres first was recommended about 50 years ago. It was abandoned 25 years ago and now it is again being used. The speaker said that he did not see the real advantage of this method except from a purely theoretical point of view. He would like to see a practical test effected with two cupolas operating together, one with the additional tuyeres, the other without them. This practical test should be conducted during the time necessary to obtain results, and then it would be possible to know whether the second row of tuyeres is really an improvement. Dr. V. Prever, Fiat automobile works, Italy, said that at foundries of this firm, this test actually is being made, but it had not been going on long enough to enable any conclusions to be drawn. Jaime Coll, Fundiciones de S. Antonio, S. A., Sevilla, said that the value of the paper lies in the fact that it opens certain lines of thought which give directions for future investigations.

The second paper was presented by Jose Salgado, Fabrica de Trubia, on "The Molding and Casting of a Locomotive Cylinder." Certain points emphasized in this paper are, the secondary importance of flexion tests and the utilization of nickel steel scrap in the cupola, which gave iron with as much as 1 per cent nickel with a correspondingly good tensile strength. This was done with coke of poor quality, yet the results were good, not so much from the point of view of the tensile strength, but especially from that of the other physical properties. The velocity of pouring was 17 kilograms (37.5 pounds) per second. M. Audo, Compagnie des Chemins de Fer, Paris-Orleans, France, said that he had reached 55 kilos (121 pounds) per second for a 5.5-ton casting. He said that the subject treated in the paper bore a close relation with the manufacture of piston rings, and that he had found rings that only showed from 4 to 5 millemeters (0.16 to 0.20 inches) wear after a distance of 55,000 kilometers (34,155 miles) had been done by the engine. Ivan Lamoureux said that he had arrived at a formula for the velocity of pouring, and had found that the weight has no influence. It is the height and the thickness of the casting that count. V. C. Faulkner said that ingot molds have been cast in Great Britain at a velocity of 44 kilograms (96.8 pounds) per second.

The next paper was entitled "Foundry Terms," by Jose Canameras Gonzalo. Replying to a remark by Aurelio Possenti, Pesaro, Italy, J. M. Espana said that the Association Technique de Fonderie of Paris is not exculsively a French organization, but includes also foundrymen of other countries, such as Spain and Italy, and that this enables cooperation in studying such questions as that referred to in the paper.

The chair then was taken by V. C. Faulkner who invited Dr. R. Moldenke to read the exchange paper of the American Foundrymen's association. The subject of Dr. Moldenke's paper was "Present Day Cast Iron and Its Improvement." It was decided on the author's suggestion that any discussion should be presented in writing. The exchange paper of the Institute of British Foundrymen then was presented by its author, Dr. Everest, who had chosen for his subject "The Use of Nickel in Iron Foundry." Replying to a question by Dr. Dresden of the effect on the cost of production of the addition of from 1 to 2 per cent nickel, the author replied that in England it is about 30s ($7.30) per ton.

Ivan Lamoureux then took the chair and asked Prof. Pisek to present the Czecho-Slovakian exchange paper on "The Microscopic Study of the Influence of Phosphorus on Reheated Cast Iron," by R. Bazant. Prof. Portevin said that the use of the dilatometric method must have been of great assistance in the author's investigations in showing the state and the quantity of the combined carbon. He agreed with Prof. Sauveur that the word steadite should be extended to all the iron phosphorus eutectics and said that hypochromite of soda is, in his opinion the best reagent to identify steadite in metallographic or microscopic examination.

"Foundry Sands—A New Testing Method," was the subject of the Belgian exchange paper presented by G. Masson and H. Compere. Prof. Portevin said that the sands should not be only characterized by their chemical composition, but that the structure is also of importance and that tests should be devised to cover that property. A speaker also pointed out that the form of the grains has an influence. The morning's session was closed with a paper by M. Lely, France, whose subject was "Improvements in the Methods of Utilizing Steel Scrap in Iron Founding."

At the next morning's session, Dr. Geilenkirchen first took the chair. A paper by Dr. V. Prever, chief metallurgist, Fiat works, Torino, Italy, on "The Technical and Scientific Organization of the Fiat Foundries," and the exchange paper of the Association Technique de Fonderie de Paris, by Leon Thomas, president of the association, entitled "By Improving Methods, Production Costs Will Decrease," were read together. Ivan Lamoureux started the discussion by stating that the original lay-out of a foundry is of the greatest importance and should be devised with a view to further possible extensions. The discussion was continued by the Spanish foundrymen present who commented upon the two papers from the national viewpoint.

Carlo Vanzetti followed in the chair, and invited Olering Langenohl to present the German exchange paper entitled: "A Summary of the Present Day Methods to Obtain High Quality Cast Irons and Considerations on the Cupola." This paper was discussed with the next by Amador Gonzales Soto, Armament Factory of Oviedo, whose subject was "Modern High Resistance Cast Irons." In opening the discussion, Mr. Vanzetti made the remark that the problem is not yet viewed from the right angle. At present there are too many variables under consideration. Prof. Portevin said that progress has been made more especially from the point of view of practical results. Cast iron always will be inferior to steel with regard to mechanical properties, but it has certain characteristics of its own which make it indispensable and which must be maintained. The present day improvements have been in the direction of better mechanical qualities, but other points should be considered, such as the skin of the casting, and particularly the aptitude of the metal to fill the mold. The high duty cast irons evolved today are sometimes difficult to cast. With low carbon content and superheating, a high casting temperature must be reached, and this has tended to modifications in the design and operation of the cupola. The drawback of the cupola is that the fuel is mixed with the metal, and it is impossible to maintain a constant composition of the metal. The speaker thinks that the duplex process by using the cupola and the electric furnace will be the development of the future.

Jaime Coll asked Dr. Moldenke and Mr. Langenohl if the cost of producing high duty cast iron is not prohibitive. The reply was that it is expensive but not so much as the cost of producing the same part in steel. Mr. Coll also asked if the metal is not oxidized at the high temperature and what is the effect of the injection of water in the cupola at the end of the operation. The reply to those questions was that the high temperature prevents oxidation and the injection of water at such temperatures is purely theoretical. Mr. Possenti said that he obtains cast iron pipes by a centrifugal process with sand molds, which yields as much as 25 kilograms per square millimeter (35,616 pounds per square inch). Ivan Lamoureux stated that a simple process of obtaining high quality iron is to use a pre-heated fore-hearth, and to heat the ladle at white heat. This is economical. Jaime Coll, Soriano, delivered a paper on "A Rapid Method of Calculating Production Costs in the Foundry," dividing his paper in three parts: Melting cost, cost of rough casting and cost of the finished casting. The session ended with a paper by Isidro Sans Darnis, the Steel Works, Viscaya, on "Test Pieces for Non-ferrous Metals."

The last session took place on April 14, the chair being held in turn by José Serrat Bonastro, Maquinista Terrestre y Maritima, Barcelona; Prof. Portevin and César Serrano. The first paper was by Prof. Portevin whose subject was "Control of the Manufacture in the Foundry," in which the author gave a complete description of the various methods of control that he recommends for the efficient operation of a foundry. This was followed by "Uses of Cast Iron in Railroad Works," by José Manuel Lacleta, Casa Mariano Corrale Hijos. The next paper by Antonio Lafont, the Fabrica Nacional de Toledo, on "Semisteel in Spain," gave rise to a discussion especially from the point of view of the manufactured shells. Following a paper by José Serrat Bonastro on "Relation between the Tensile Strength and Flexion in Cast Iron Test Pieces," Dr. Dresden, Holland, said that the formulas of resistance of materials do not apply to cast iron.

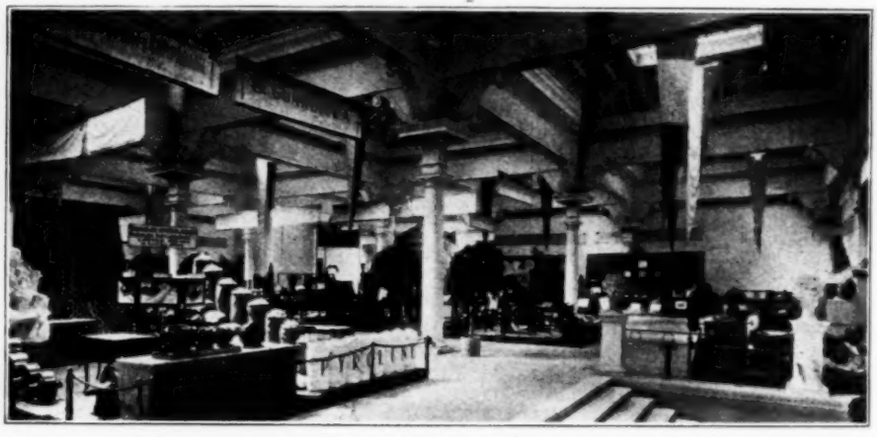


Fig. 3—Raw Materials Obtained in Spain, Castings Manufactured in Spanish Foundries, and Foundry Equipment Were Shown

Dr. Dresden then read a contribution on "Experiments with Iron Rods Embedded in Cast Iron." This was the Dutch exchange paper by Dr. Dresden and D. H. Stoffel. Ivan Lamoureux stated that he had found that it is the phosphorus that renders the connection of the rod with the casting fragile. The use of hematite pig iron prevents this difficulty but there is no welding of the rod in that case. In conclusion Mr. Lamoureux said that he does not believe in embedding rods and prefers to screw them in the casting. Mr. Brunent explained his method of embedding iron tubes in certain cast iron vats. After a number of experiments, he found that the best results were obtained when the tubes had been reheated and pickled. The following papers were read without discussion: "Cast Iron Testing," by Agustin Plana, Central Laboratory of Artillery. "A Contribution to the Study of Foundry Technical Terms",

(*Concluded on Page* 389)

Expounds Principles
OF SUCCESSFUL CUPOLA OPERATION-III

By John W. Bolton

SOME foundries still cling to the archaic practice of a double first charge. Many writers have pointed out the fallacy of this practice. With a double first charge if the first iron is cold, then hot, it means that an unnecessarily high bed is used. Therefore, there is no real coke economy in the practice as a lower bed would give uniformly hot metal. However, there is danger of *spotty* iron and non-uniformity in composition. There are many tuyere designs, and even more opinions than designs. Careful researches show that it is the air volume delivered rather than the shape of tuyeres that determines melting rate. It has been claimed repeatedly that upper tuyeres offer no real advantages and may do more harm than good but they have many adherents. With volume the same, restricted tuyeres areas (hence higher static pressures) tend to shoot the blast more to the center as shown in Fig. 16. This is easier on the lining and seems to favor lower carbon and silicon. Larger tuyere area, same volume, seems desirable when melting soft weak irons. Excess in this direction will result in badly scored lining just above the tuyeres.

Some foundries get by using only the old fashioned pressure gages. The author has had occasion to check up on various cupolas operated in this manner. In every case he obtained improved results by use of a volume meter to regulate the blast. The only big changes in this practice were in adjusting the constant volume and better making and burning of bed.

Concludes the Series

THIS is the third and concluding article of the series by Mr. Bolton on rational cupola practice. In this article the author mentions volume control, temperature measurement and methods of carbon control. He also includes a bibliography of articles, books, etc. that deal with the subject of cupola practice.

The optical pyrometer is the only reliable and practical judge of the actual temperature of iron at the spout. Recent investigations indicate that these pyrometers when used with the proper correction factors for radiation are capable of giving readings which are close to those obtained by thermocouple pyrometers immersed in the metal. One pyrometer matches the brightness of a lamp filament with that of the stream of iron. The filament brightness is varied to suit by the current supplied. This current is indicated on a portable ammeter and can be interpreted in degrees by a chart supplied by the manufacturer.

In a second pyrometer the filament is set to a constant amperage and brightness and a wedge of colored glass is increased or decreased in thickness by rotating a knurled knob. The glass is between the stream and the filament. By rotation the apparent brightness of the stream is increased or decreased until a match is made. The placement of the glass is indicated by a pointer which indicates the temperature, uncorrected. Either of these pyrometers is rugged and easy to operate. Different operators check closely.

Radiation pyrometers have been advocated but the author finds them too fragile for foundry use. In these pyrometers the radiation is received in the telescope, and through a system of mirrors and lenses the light is focused on a tiny thermocouple. This couple is attached to a delicate millivoltmeter, arranged to indicate the temperature. An ingenious arrangement for obtaining the *relative* temperature of the stream devised by H. W. Diedert and W. M. Myler,

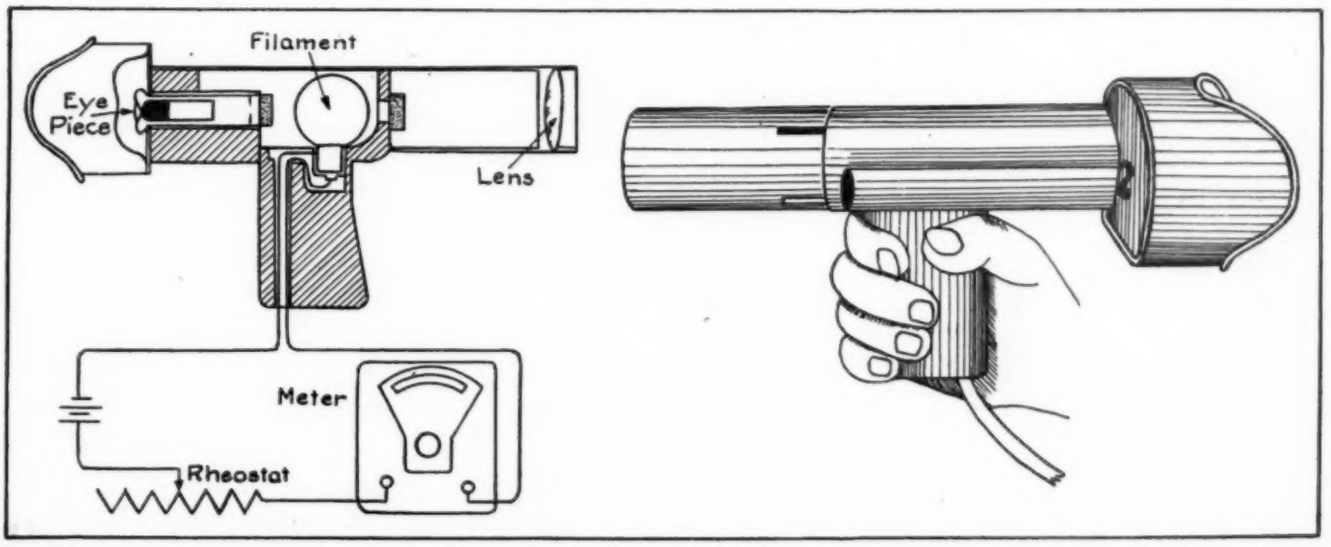


FIG. 14—DIAGRAMMATIC SKETCH OF AN OPTICAL PYROMETER SHOWING THE VARIOUS PARTS. FIG. 15—SKETCH OF A WELL KNOWN OPTICAL PYROMETER AS USED

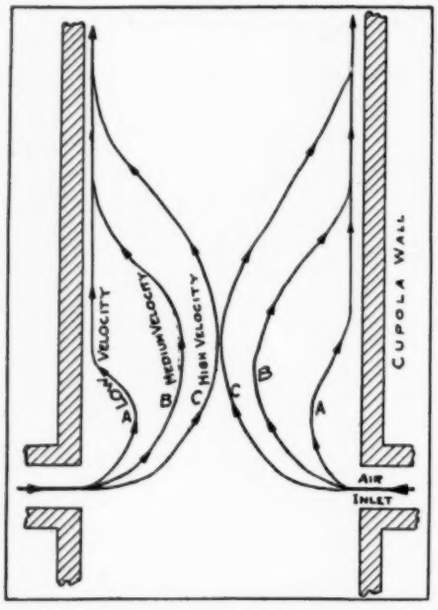


FIG. 16—AIR FLOW IN A CUPOLA FURNACE SHOWING THEORETICAL PATH

Jr. was described in THE FOUNDRY, June 1, 1926. A thermocouple is held at a constant point above the stream and is connected to a millivoltmeter, or to a potentiometer with a scale graduated in degrees which indicates the relative temperatures. This arrangement is particularly useful when running a continuous tap. The device also can be connected with an automatic recording arrangement. The bureau of standards publishes an excellent pamphlet on pyrometry, *Pyrometric Practice*, technologic paper No. 170 which should be in every foundry library.

How hot is hot iron? This varies somewhat according to the mixture used. Low phosphorus and high steel mixtures are capable of absorbing most superheat before dropping through the melting zone. High carbon and high phosphorus irons melt a little colder. The author regards all above 2750 degrees Fahr. as hot

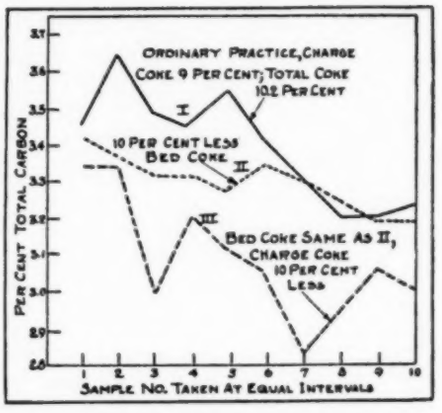

ORDINARY PRACTICE, CHARGE COKE 9 PER CENT; TOTAL COKE 10½ PER CENT
10 PER CENT LESS BED COKE
BED COKE SAME AS II, CHARGE COKE 10 PER CENT LESS
I
II
III
PER CENT TOTAL CARBON
SAMPLE NO. TAKEN AT EQUAL INTERVALS

FIG. 17—CURVES SHOWING THE RELATION OF BED HEIGHT, CARBON AND CHARGE COKE

cupola metal. He has seen iron close to 2900 degrees Fahr. Good iron is from 2700 to 2750 degrees. Fair iron ranges from 2650 to 2700 degrees. Under 2650 degrees is not hot iron. The lowest tap the author

Bibliography of Cupola Practice

BOOKS

The Cupola Furnace, by Edward Kirk.
Principles of Iron Founding, by Richard Moldenke.
Cupola Practice, as given in the correspondence course of David McLain, McLain's System, Goldsmith building, Milwaukee.

GENERAL CUPOLA PRACTICE

Cupola Practice, by P. Longmuir, *Engineering Review*, 1905, pp 895-904.
Design and Operation of the Cupola, by C. H. Jaeger, *Stahl und Eisen*, 1907, 339-342.
Cupola Construction, by T. D. West, *Iron Age*, 1908, pp 838-839.
Melt Iron with Best Results, by R. Moldenke, THE FOUNDRY, 1913, p 503.
Overcoming Cupola Troubles, by P. Ramp, *Iron Age*, 1918, pp 946-948.
Fuel Economy in Cupola Practice, by H. J. Yates, *Trans.* Iron & Steel Insti., 1919.
Production of Good Iron Castings, by R. Moldenke, *Iron Age*, 1920, pp 191-193.
Cupola the Heart of the Foundry, by J. R. Hedges, THE FOUNDRY, 1922, pp 156-157.
Records Show Cupola Control, by S. J. Felton, THE FOUNDRY, 1924, pp 255-257.
Rational Cupola Practice, by E. J. Lowry, 1927, THE FOUNDRY, pp 936-938.
Cast Iron Data Sheets, A. S. S. T. *Handbook*, Sec. 0 pp 3-18, by H. Bornstein and J. W. Bolton.
General Cupola Practice, by Pat Dwyer, THE FOUNDRY, 1923, pp 318, 368, 419, 444, 502, 549.

THERMAL, GAS INVESTIGATIONS, ETC.

Quantity and Composition of Cupola Cases, by G. Busek, *Stahl und Eisen*, 1911, pp 712-714.
Fuel Efficiency of the Cupola, by J. J. Porter, 1912, *Trans.* Eighth Int. Cong. of Applied Chemistry, 1912.
Foundry Cupola Gases and Temperatures, by A. W. Belden, Bull. 54, U. S. Bureau Mines.
Scientific Management of Cupola, by E. K. Hammond, THE FOUNDRY, 1913, p 408 on.
Experimental Investigation of Melting, by F. Huser, *Stahl und Eisen*, 1913, pp 181-190.
Cupola Studies, by H. B. Pulsifer, *Chem. Engineer*, 1914, pp 109-113.
Thermo-physics of Cast Iron, by R. Moldenke, *Iron Age*, 1916, p 1459.
Cupola Operations, by F. Braun and G. Hollender, *Stahl und Eisen*, 1921, pp 1021-1027.
Chemical Reactions in the Cupolas, by Y. A. Dyer, *Iron Age*, 1921, pp 259-261.
Theories on Cupola Reactions, by S. J. Felton, THE FOUNDRY, 1923, pp 351-352.
Foundry Cupola Gases and Temperatures, by A. W. Belden, *Bull.* Brit. Cast Iron Research association, 1923.
Observes Melting in Cupola, by J. Grennan, THE FOUNDRY, 1923, pp 908-910.
Thermal Regulation of Cupola, by E. Piwowarsky and F. Meyer, *Stahl und Eisen*, 1925, pp 1017-1022.
Notes on Chemistry of the Cupola, by F. Thompson and M. Becker, *Metal Industry*, 1926, pp 111-112.
Investigation of Iron Melting, by A. W. Belden, THE FOUNDRY, 1913, p 456 on.

SEMI-STEEL

Use of Steel Scrap in the Cupola, by C. R. McGahey, *Chem. Eng.*, 1909, p 26-27.
Production of a Cast Iron, by C. Bingel, Ger. Pat. 243,237, 1912.
Melting Steel and Gray Iron in a Cupola, by D. McLain, *Iron Age*, 1916, pp 781-782.
Nature and Uses of Semi-Steel, by H. Howel, *Proc.* Brit. Fd. Ass'n., 1914-1915.
Manufacture and Properties of Semi-Steel, by D. McLain, *Iron Age*, 1916, pp 702-704.
Semi-Steel Shells, by E. Ronceray, THE FOUNDRY, 1918, pp 93-96.
Manufacture of Semi-Steel for Shells, by F. E. Hall, *Iron Trade Review*, 1920, pp 414-416.
Steel Scrap in Cupola Mixtures, by E. J. Lowry, *Iron Age*, 1922, pp 337-338.
Metallurgy of Semi-Steel, by D. McLain, *Iron and Steel* (Canada), 1922, pp 206-210.
Melting Semi-Steel in a Cupola, by J. Grennan, *Trans.* A. F. A., 1924, pp 448-463.

HIGH-TEST IRONS AND SUPER-HEATING

Reducing and Refining Iron, by H. Johnson, United States patent 952,260 (1910).
Cupola Furnace, by E. Schurmann, German patent 266,303 (1912).
Cast Iron, by R. Anderson, British patent 3,354 (1913).
Iron Manufacture, by J. E. Fletcher and J. Harrison, British patent 7,691 (1915).
Refining Iron, by A. Jackson, British patent 147,999 (1919).
Cast Iron Alloys Low in Carbon, German patent 332,236 (1917).
Preparing Iron for Castings, by W. G. Kranz, Canadian patent 180,131 (1917).
Side Blast Cupola at Chicago, by S. G. Wagner, *Iron Age*, 1923, pp 1377-1379.
Wust Furnace for High Quality Iron, by T. Klingenstein, *Stahl und Eisen*, 1925, pp 1476-1478.
Malleable Cast Iron or Steel, by Emmel and Thyssen, British patent 249,800 (1925).
Cast Iron, by Emmel and Thyssen, British patent 244,405 (1924).
Cast Iron, British patent 247,941 (1925).
Low Carbon Cast Iron from Cupola, by K. Emmel, *Stahl und Eisen*, 1925, pp 1466-1470.
High Quality Iron by Superheating, by E. Piwowarsky, THE FOUNDRY, 1927, pp 298-302.

SLAGS, COKE

Desulphurization in the Cupola, by O. Vollenbruck, *Iron Age*, 1915, pp 468-469.
Blast Furnace and Cupola Slags, by J. E. Fletcher, *Trans.* Iron and Steel Inst., 1921.
Production and Use of Foundry Coke, by R. Moldenke, THE FOUNDRY, 1911, p 200.
Characteristics of Foundry Coke and Slags, by Y. A. Dyer, *Iron Age*, 1921, pp 407-409.
How Slags Affect Cupola Operations, by J. W. Bolton, THE FOUNDRY, 1921, pp 675-682.
Coke and Its Behavior in the Foundry, by H. Koppers, *Fuel*, 1923, pp 160-165.
Desulphurization and Reduction in Cupola, by A. Wagner, *Stahl und Eisen*, 1925, pp 1202-1205.
Desulphurizing Iron, by G. S. Evans, United States patent 1,590,-730—1,590,739.
Desulphurization of Cast Iron, Bulletin No. 15, British Cast Iron Research association.

ever has seen in eight years was 2510 degrees Fahr. Dull iron is red and plainly sluggish. Fair iron shows many *streaks* in the stream and flowers readily in the ladle. Hot iron is whiter, with a few streaks. It exhibits little flowering in the ladle. Extremely hot iron is milky white and fluid. It shows no streaks and the stream often appears on fire right down into the ladle. The iron in the ladle is dazzling to the eye and the convection currents bring about no flowering.

Carbon Control

Late years have brought forward the importance of low carbon in the manufacture of strong irons. Obtaining low total carbon from the cupola is accomplished by two practices: (1) Charging stock low in carbon. (2) Preventing the absorption of too much carbon from the fuel or from the gases evolved from combustion.

Regular pig iron usually contains from 3.70 to over 4.00 per cent total carbon. This is high. Within the last few years some English and Continental firms have been marketing low carbon pig iron. The use of steel scrap was advocated by David McLain and many foundrymen lowered their carbons somewhat by this method. However, percentages of steel charged usually ran from 10 to 25 per cent and too much absorption of carbon from coke cut down the effectiveness of steel additions according to some investigators, E. J. Lowry, *Iron Age*, 1922. In recent developments the cupola has been charged with 80 to 100 per cent steel. Carbon in the resultant metal may be 2.50 to 2.75 per cent. The metal is re-siliconized with ferrosilicon, or softened by nickel, or both.

Carbon absorption from the fuel is minimized in several ways: (a) Low bed favors low total carbon. (b) Cutting the charge coke to the minimum required for hot iron helps in keeping the carbon down. (c) Various cokes differ in the amounts of carbon they give to the iron. (d) Excessive air and sharp blast tend to keep carbon lower. (e) Shallow well and constant tap favor low carbon. (f) Coke has been coated with lime wash to prevent carbon absorption. The author has not given this a thorough trial. (g) Low temperature diminishes the carbon absorbing power of iron by lowering the saturation point. This expedient is dubious. (h) High silicon and high phosphorus lower the carbon absorbing power of iron. The use of these is attended with other difficulties.

Some three hundred and fifty valuable articles have been written on cupola practice. However, the average foundry executive has not the time or the facilities to study over this vast number of publications. The accompanying table does not pretend to give all the good articles on cupola practice, or necessarily the best ones. The author is passing no judgments, and quite probably has overlooked many excellent papers.

In addition to these articles, and others of their kind, the reader is referred to publications on use of briquets, tuyere design, oil, coal, and charcoal burning in cupolas, preheated blasts, auxiliary air and oxygen additions, forehearths, etc. Much valuable information is contained in such papers.

Barcelona Meeting Is Successful

(*Concluded from Page* 386)

by J. M. Espana and J. C. De Sequeria, engineer at the Portuguese railroads. "The Laboratory for the Small Foundry," by Francisco Cuesta, Ordnance Manufacture, Sevilla. "A Contribution to the Study of Chemical Analysis and Tests," by César Serrano. "A Contribution to the Study of the Analysis of the Total Carbon and the Present Tendency," by Erneste Llamas del Tore, Manufacturer of Arms, Oviedo. "The Physical Properties of 78/28 and 90/10 Brasses in Relation to the Final Reduction and the Previous Reheating," by José Fernandez Ladreda.

In the afternoons of the preceding days, visits were arranged to the works of the Hispano-Suiza automobile company, the Maquinista Terrestre y Maritima, locomotives, the Fabrique de Compteurs and the Grau Foundry, the Mas-Baga and Escorsa foundries, the Sert works and the Industrial School. A banquet was held on the Saturday, when about 300 delegates assembled around the tables. On the next day, a large number of the visitors left for the post-convention tour, which included Valencia, the Sagunto works, Cordoba, Sevilla, Toledo, Madrid, Bilbao and San Sebastian where the party broke up.

Sells Shakeout Equipment

The Stoney Foundry Engineering & Equipment Co., Cleveland, recently has sold two shakeout bails to the Studebaker Corp., South Bend, Ind., and one shakeout bail each to the Ypsilanti Foundry Co., Ypsilanti, Mich., the Humphreys Mfg. Co., Mansfield, O., and the Weil-McLain Co., Michigan City, Ind. The Stoney company also has sold vibrator and shakeout equipment to the following foundries: Buick Motor Co., Flint, Mich.; American Radiator Co., Black Rock, N. Y.; Rundle Mfg. Co., Milwaukee; Estate Stove Co., Hamilton, O., Holmes Foundry Co., Port Huron, Mich.; International Harvester Co., Hamilton, Ont.; Lakey Foundry & Machine Co., Muskegon, Mich.; Cincinnati Milling Machine Co., Cincinnati; Henry Furnace & Foundry Co., Medina, O.; Griffin Wheel Co., Council Bluffs, Ia.; Wilson Foundry & Machine Co., Pontiac, Mich.; Dayton Steel Foundry Co., Dayton, O.; Southern Wheel Co., Toledo; Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.; International Heater Co., Utica, N. Y.; Griffin Wheel Co., Cincinnati; John Deere Tractor Co., Waterloo, Ia.; Westinghouse Air Brake Co., Wilmerding, Pa.; American Foundry Co., Indianapolis; United States Radiator Corp., Geneva, N. Y.; Oil Well Supply Co., Oil City, Pa.; Emerson-Brantingham Corp., Rockford, Ill.; Conemaugh Iron Works, Latrobe, Pa.; Richmond Radiator Co., Uniontown, Pa.; and Koken Company, St. Louis, Mo. The American Radiator Co., Springfield, Ill., has purchased two separate knockout machines, one for removing the sand from the molds and the other for removing the core and arbors from the pipe castings.

Sand Production Increases

Molding sand production increased 6 per cent in quantity and 4 per cent in total value in 1926 according to a recent publication on sand and gravel by the department of commerce. States leading in total output were Illinois, Indiana, Ohio, Michigan, New York, Pennsylvania and New Jersey, the output ranging from 779,452 tons for Illinois to 468,757 tons in New Jersey. States leading in total value were New York, Ohio, Pennsylvania, New Jersey, Illinois, Michigan and Indiana, the value ranging from $1,171,821 in New York to $356,921 in Indiana. Molding sand sold or used by producers in the United States from 1917 to 1926 are given as follows:

		—Value—	
Year	Short tons	Total	Average
1917	4,660,968	$4,303,809	$0.92
1918	4,910,178	5,121,865	1.04
1919	3,774,612	4,153,990	1.10
1920	5,128,075	7,504,759	1.46
1921	1,906,977	2,451,966	1.29
1922	3,839,116	4,478,405	1.17
1923	5,559,644	6,730,417	1.21
1924	4,403,893	4,995,268	1.13
1925	4,995,428	5,400,618	1.08
1926	5,309,166	5,630,799	1.06

George B. Michie has been made western representative of the Niagara Falls Smelting & Refining Corp., Buffalo, with headquarters at Chicago.

Electrochemists Discuss Problems Related to Electric Heating

MANY phases of electric heating in industry were discussed at the annual meeting of the American Electrochemical Society, held last week at Hotel Stratfield, Bridgeport, Conn. A feature of the meeting was a round table discussion on refractories headed by Dr. B. D. Saklatwalla, head of research department, and vice president, Vanadium Corp. of America, Bridgeville, Pa.

More than 200 members and guests were registered from many parts of the world. The list included representatives from Germany, Japan, Switzerland and Canada. One whole day of the three-day meeting was given over to the study of the chemical production of electricity. Inspection trips were made to many Bridgeport plants, including the Bridgeport Brass Co., General Electric Co., Remington Arms Co., American Tube & Stamping Co., and the Dictaphone Co. This is the twenty-sixth year in the history of the society. The fall meeting will be held at Charleston, W. Va. On Friday evening, a dinner and entertainment was held at "The Farm" on Long Island Sound.

New officers were elected at the annual business meeting conducted on Friday morning. The names of those elected appear in the accompanying box.

Refractories Trail Furnace Design

The round table discussion of refractories brought out the fact that the development of refractories for high-temperature electric furnace work has not kept pace with the design of electric furnaces, with the result that electrochemists engaged in electric furnace operation, especially those working with copper in induction furnaces, are eagerly seeking better refractory material. In introducing the subject, the chairman, Dr. B. D. Saklatwalla, listed the principal properties desired in a good reflectory. These include, refractoriness, resistance to slagging, resistance to metal infusion, resistance to oxidation, resistance to combining with the metal in any way, resistance to spalling, low heat conductivity, low electrical conductivity and high strength.

In answer to a question as to what refractories have been developed for use by electric furnaces in melting copper, several different materials were suggested. One was magnesia

PAUL J. KRUESI

cement supplied in dry form and rammed in at the plant. Another was a 76 per cent alumina material electrically fused. The relative merits of ramming and pre-forming of refractories were discussed at length. Rammed-in linings seem to give good results and, particularly are adapted to induction furnace work on copper.

Many electric furnace operators gave their experiences with different linings. One man told of his practice of seasoning a lining for a period up to six months before putting it into production. Several manufacturers said that they started production slowly with a new lining, usually over a period of three or four days making the first heat without any production. One manufacturer uses a wash heat consisting of lime and silica sand to slag out a new lining. Afterwards, this is washed down. An electric steel manufacturer pointed out that it was often a disadvantage to have a refractory too low in heat conductivity. He said that a higher conductivity would keep the refractory temperature lower, due to radiation. In making up refractory linings, one of the difficulties is with the bond. If this burns out, it leaves the refractory porus. To overcome this, it was suggested to use a bond consisting of a highly pulverized product of the refractory material itself.

Electricity Is Widely Used

Robert M. Keeney, industrial heating engineer, Connecticut Light & Power Co., Waterbury, Conn., presented an illustrated paper on annealing of nonferrous metals in the electric furnace. He said that the problem of heat for annealing nonferrous metals and alloys, was an economic one. Items which influence over all costs, he said, are pickling, fuel, power, labor, maintenance, and capital charges. Often, a manufacturer is misled as to the relative costs of different methods of heating by not considering all of these various items. Simple comparisons of the B.t.u. cost of electricity, oil, or coal, give an erroneous impression, according to the speaker, because no allowance is made for higher furnace efficiency, lower labor costs, elimination of spoilage, less pickling and other similar items.

In the discussion following this paper, there was some question as to the cost of electricity. Mr. Keeney pointed out that where a substantial load was all ready connected up the additional power required for a furnace installation should be considered

New Officers

AMERICAN ELECTROCHEMICAL SOCIETY

President

PAUL J. KRUESI
President, South Ferro Alloys Co., Chattanooga, Tenn.

Vice Presidents

F. C. FRARY
Director of Research, Aluminum Co. of America, Oakmont, Pa.

F. N. SPELLER
Metallurgical engineer, National Tube Co., Pittsburgh

ALFRED STANSFIELD
Professor of metallurgy, McGill university, Montreal, Que.

Managers

F. M. BECKET
Vice president, Union Carbide Co. and Electro-Metallurgical Co., New York

L. E. SAUNDERS
Manager, abrasive plants, Norton Co., Worcester, Mass.

S. SKOWRONSKI
Research chemist, Raritan Copper Works, Perth Amboy, N. J.

Treasurer

ACHESON SMITH
Vice president and general manager, Acheson Graphite Co., Niagara Falls, N. Y.

Secretary

COLIN G. FINK
Head, division of electrochemistry, Columbia university, New York

on the basis of the rate for the increased load and not pro-rated as part of the total load. In other words the rate is reduced as the load increases and the study of any apparatus to be added to the existing installations should be made at the lowest rate or the actual amount which the addition will cost in power. Rate structures necessarily are complicated and estimates should be secured from the power company.

New York Group Meets

The twelfth annual meeting of the Central New York State Foundrymen's association was held in the Hotel Syracuse, Syracuse, N. Y., Friday, April 12. The morning session was devoted to reports of various committees and the election of officers. At the afternoon session the following papers were presented: "Extending the limitations of Cast Iron by the Use of Alloys," by D. M. Houston, the International Nickel Co., New York; "The Proposed Gray Iron Institute," by William H. Barr, National Founders association, Buffalo; "Basic Principles in Foundry Management," by J. D. Towne, Dayton, Ohio. The following officers were elected: President, W. W. Cheney Jr., S. Cheney & Sons, Manlius, N. Y.; vice president, L. K. Devendorf, Albany Foundry Co., Albany, N. Y.; secretary and treasurer, W. E. Walker, E. C. Stearns & Co., Syracuse, N. Y. The executive committee is composed of the following: A. J. Kennedy, Sandy Hill Iron & Brass Works, Hudson Falls, N. Y.; E. O. Buesing, McIntosh & Seymour, Auburn, N. Y.; J. L. Lonergan, Morris Machine Works, Baldwinsville, N. Y.; and D. H. Wray, Henry Wray & Sons Co., Rochester.

Tells How to Do It

Recently the Paul F. Hermann Co., Pittsburgh, published a booklet which describes its new compound for making standard patterns, match boards, special patterns and core boxes, and the methods for using it. The materials consist of two powders and two liquids. One of the powders and one of the liquids form the compound itself, and the other powder and liquid are used respectively for glazing the mold surfaces and for protecting metal reinforcements against rust.

The Equipment & Supply Co., P. O. Box 110, Baxter avenue station, Louisville, Ky., has opened offices and a display room and will specialize in mechanical equipment, machinery, construction materials and supplies.

Establishes Standard Trade Customs for the Steel Foundry Interests

When purchasers ask for quotations they should give the actual or estimated rough weights of the castings upon which quotations are to be based.

Unless otherwise arranged, quotations should be accepted and pattern equipment furnished to the foundry by the purchaser within thirty days from the date of such quotations.

Unless otherwise specified, castings are sold as unmachined castings, f.o.b. the foundry. Terms of sale are net cash 30 days from date of invoice. No cash discounts are allowed.

Pattern equipment should be in proper condition and of a type suitable for the economical production of castings of the quality, quantity, and delivery required.

Before patterns are made, the purchaser should submit blueprints to the foundry that is to make the castings, to obtain suggestions concerning the best method for constructing the pattern equipment.

When the purchaser furnishes skeleton patterns, coreboxes, sweeps, or conjunction patterns which increase the cost of production of castings, an extra charge will be made.

Patterns should be painted in accordance with the following standard practice:

Surfaces to be left *unfinished* are to be painted *black.*

Surfaces to be *machined* are to be painted *red.*

Seats of and for loose pieces are to be *red stripes on a yellow background.*

Core prints and *seats for loose core prints* are to be painted *yellow.*

Stop-offs are to be indicated by *diagonal black stripes on a yellow base.*

As developed by the Steel Founders' Society of America.

Patterns, coreboxes, and loose pieces thereof shall be properly marked for identification.

Alterations and repairs on pattern equipment shall be paid for by the customer.

The foundry shall not be responsible for loss of, or damage to pattern equipment when caused by fire or other causes beyond its control.

The foundry shall not be expected to provide storage for patterns for which no orders have been received during a period of two years.

All transportation charges on pattern equipment to and from the foundry shall be paid by the customer.

Unless requested in writing, changes in orders will not be accepted by the foundry.

To be effective, cancellation of orders must be agreed to mutually by the foundry and the customer.

After the original order is in production the customer shall reimburse the foundry for castings made or for molds or cores discarded by the foundry due to cancellation, changes in orders, or alterations in pattern equipment.

The foundry shall not be liable for damages due to failure to make delivery of castings when such delay is caused by fires, strikes, accidents, or other and additional causes beyond the foundry's control.

Claims for errors in weight or in number of castings received shall be made by the customer within ten days after the receipt of the castings.

The foundry shall not be responsible for machine work or other expense incurred on castings which are later rejected as defective.

The foundry has the right to replace castings rejected by the customer as defective.

The foundry shall not be liable for any special, indirect, or consequential damages whatsoever, in connection with any castings it furnishes.

Removing the Hazards from

Piece Price Quoting

Careful Analysis of the Layout Forms a Basis for Computing Weights—How the Weights on a Side Frame Casting Are Compiled

By O. C. Gilbert
(Consulting Engineer, Chicago)

Part IV

WEIGHT layouts for railways specialty castings usually are made half size. They are made upon a cheap grade of tracing paper in pencil and require from 1½ hours for a simple side frame with uniformly thick walls to a day for a heavy side frame having unusual features and frequently changing thickness dimensions for the walls.

After the layout is made and before any attempt is made to mark off the areas as shown in Fig. 4 the layout should have the wall thickness written in at every point where the thickness changes. These dimensions may be encircled in pencil to obviate any possibility of their being taken as the numbers of isolated areas.

In the isolation of areas for volume calculation the only safe way is to isolate one area at a time and immediately write the three dimensions on the estimating sheet. Numbering several areas at one time and then transferring them to the estimating sheet invariably leads to the use of the same number or several of them more than once and the duplicated areas consequently are left out of the estimate and are easily overlooked by the checker.

As far as it is possible to do so without inviting confusion, all lines on a weight layout are made solid lines. It will be noted that the only use of dotted lines on the layout is to show the circular pad at the point where the columns and the spring seat join, and the web marked on the plan view Nos. 16 and 17 is dotted where shown on the side elevation.

The Nos. 1 to 18 inclusive would here be shown in red crayon to indicate that they are transverse volumes and the boundary of each piece should be shown by a red crayon dot or line on each boundary. The lines and arrows on the layout are not necessary except in the case the work will be checked by a man not fully familiar with the procedure, in which case it is sometimes advisable to copy on each piece the three dimensions of that piece.

The pieces numbered 19 to 30 inclusive would be numbered in blue crayon and the boundaries of these pieces indicated by blue lines or dots, thus showing that they compose the side sections of the measured piece.

Drawing No. 9763			BOLSTER		ADDITIONAL PARTS SUPPLIED DEAD
Customer A. B. C. R. R.					LEVER BRACKET 6 LBS.
					RIVETS 1 LBS.
Pattern No 973 A					QUOTING WEIGHT -716 A727
9/20/27	—		EST. WT. 709	RUNNING WT. (11/1/27 (2)	699) (11/5/27 (56) 700
11/5/27	A		720	12/10/27 (56)	715

FIG. 3—THE ESTIMATING SHEET A LWAYS IS PREPARED IN DUPLICATE

The pieces numbered 31 to 33 inclusive would be numbered and bounded in green crayon to show that they are beads.

The triangular part marked *A* at the bottom of the large piece No. 24 in the tension member would be marked in yellow to show that it is to be deducted to compensate for the manner in which the part 24 was taken.

The deduction *B* would also be marked in yellow as this is also a compensating deduction on account of the fact that part 9 was considered as of ⅞-inch thickness throughout its length whereas it is only ¾-inch thick at the extreme left-hand end and between the side walls there.

In determining the width of taper members, such as No. 6, the middle point of the piece is determined and this point is projected to the plan view where the width is scaled. Because of the frequent large size of such pieces, it is essential that the plan view be drawn carefully to scale with a wedge pointed pencil.

In the dimensioning of areas, such as No. 24, caution must be taken in the determination of the vertical height and not only must the layout be closely held to scale, but the point at which the vertical height is scaled must be exactly in the center of the projected lineal dimension and it must be exactly in the center of the projected lineal dimension and it must be carefully scaled.

An error almost universally encountered in the work of a new estimator in such pieces is the use of the projected lineal length times the average slant width which is, of course, geometrically incorrect and introduces a large error.

Caution must also be taken not to scale parts such as No. 4 and Nos. 16 and 17 on the plan view except for the dimension as to width. The lineal length must be taken from the side elevation by projection.

In parts such as No. 9, the curved portions are stepped off with dividers and in a long curved piece the dividers should be checked as to their setting by stepping off ten units and multiplying the unit to which the divider is set by ten after which the ten units are compared to a scale to check for setting error.

In the use of dividers for stepping off lineal lengths, the divider should be used only for the part of the piece that is not straight; thus in part No. 9 the dividers would be used only around the bend at the left-hand end, the remainder being scaled by a ruler.

It will be noted that part No. 2 which is the top or compression member, tapers both as to thickness and width and therefore constitutes a true pyramidal frustrum. It also can be

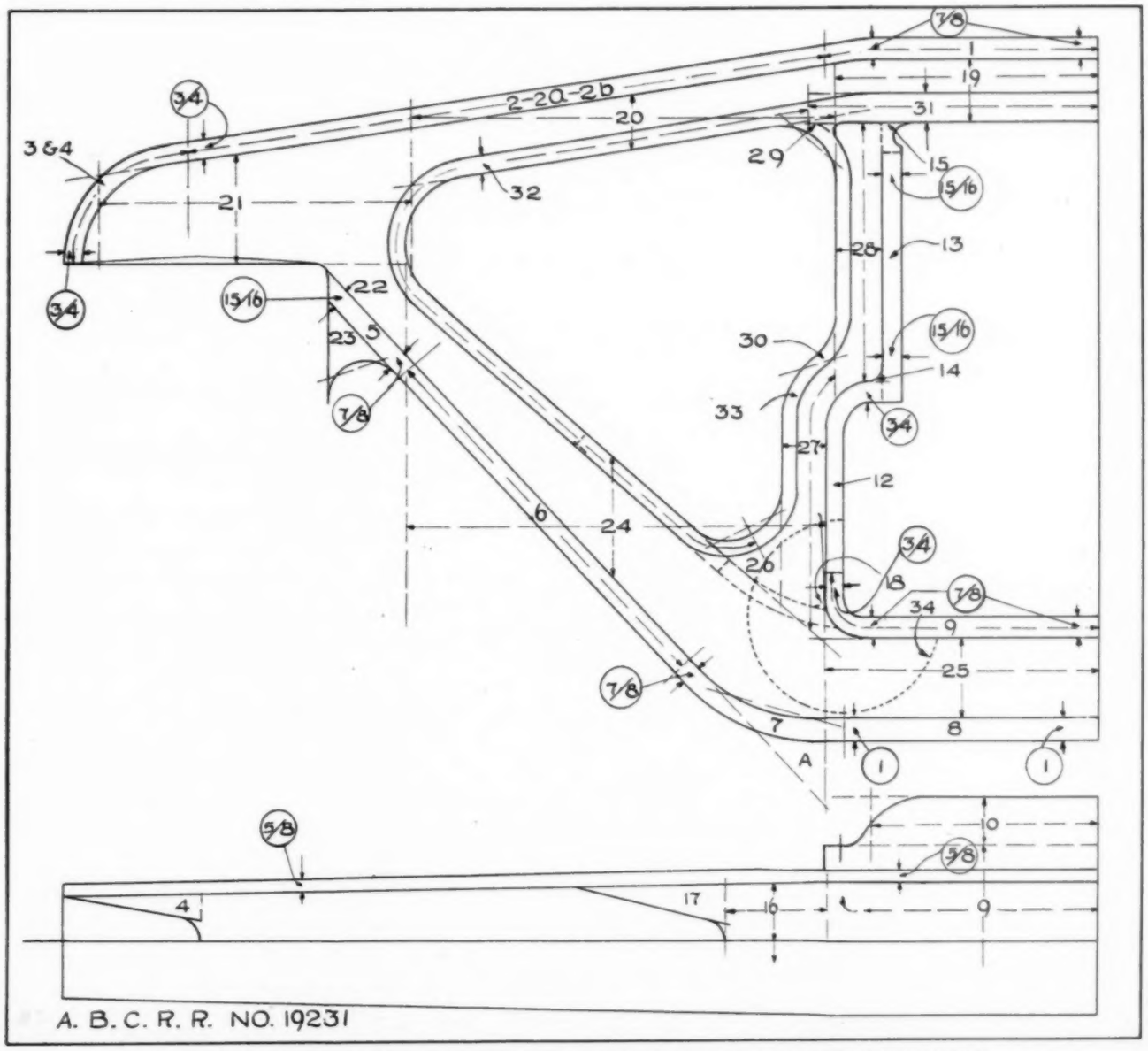


FIG. 4—THE LAYOUT IS MADE TO DISSECT THE VARIOUS PARTS OF A PATTERN FOR ANALYSIS

seen that this piece is rather large and because of this it is divided into three parts—2-2a-2b—which are first a uniformly thick quadrilateral then a rectangular wedge and lastly two pyramids. It is easier to do this than to use the formula for a pyramidal frustrum and there is less likelihood of mistakes either in estimating or checking. It also will be noted that the part No. 7 is also a double taper member, but here because of the small error involved the part is calculated by multiplying the average width by the average thickness by the length.

Part No. 21 has been squared off at the left-hand end. This procedure is an enormous time saver and does not affect the accuracy of the estimate when the practice is carefully carried out. The same device was used in part No. 31 where the triangular area included at the upper left-hand end balances the area not included in the bead, part No. 30.

On the estimating sheet opposite the entry for part No. 11 and No. 15, a mark will be noticed at the left-hand margin of the sheet. This is to indicate that the area involved is not shown on the layout, but is marked in red pencil on the blueprint. In both cases the pieces involved are fillets that are on the front elevation.

DRAWING NO. 19,231
CASTING Side Frame
FOR A.R.C.R.R.
WEIGHT 869 Pounds
ESTM. C.R.R. DATE 2/13/28.

Mark	Number of pieces												
1	1	Top	7/8	6	11 1/2		69.00			6	0	3	8
2	1	Top	3/4	5 1/2	26 1/4		4.13						
2a	1	Top wedge	1/8	5	26 1/4	(1/2)	.31	4.48					
2b	2	Top pyramids	1/8	1/2	26 1/4	(1/3)x(2)	.04			1	1	7	6	0
3	2	Top	3/4	5/8	8	(2)	10.00						
4	2	Top △ 8	3/4	15/16	6 1/2	(1/2)(2)	6.09	16.09		1	2	0	7
5	1	Bottom	29/32	5 3/8	4 3/4		25.53			2	3	1	4
6	1	Bottom	7/8	5 1/2	16 11/16		91.78			8	0	3	1
7	1	Bottom	15/16	5 7/8	7 3/8		43.69			4	0	9	7
8	1	Bottom	1	6	10 3/4		64.50			6	4	5	0
9	1	Spring Seat	7/8	8	12 13/16		102.50						
10	2	Spring Seat	7/8	2	9 3/8	(2)	37.50	141.76					
11	2	△8	7/8	15/16	1 7/8	(1/2)(2)	1.76			1	2	4	0	4
12	1	Column	3/4	6	8 7/8		53.25			4	9	9	2
13	1	Column	15/16	8	10 1/2		84.00			7	8	7	5
14	1	Column fillet	4 3/4	(Area fillet) (3/4" radius)			0.12					5	7
15	2	Column top fillets	15/16	3/4	1 1/2	(2)	2.25			2	1	0	9
16	1	Webb	5/8	4 3/4	4 5/8		21.97						
17	2	△8 Webb	5/8	1 1/2	8	(1/2)(2)	12.00	33.97		2	1	2	3
18	1	△ Webb fillet	4 3/9	7/8	3/4	(1/2)	0.33				1	5	7
19	2	Sides	5/8	2 5/8	10 3/4	(2)	56.44						
20	2	Sides	5/8	2 1/4	17 7/8	(2)	80.44						
21	2	Sides	5/8	4 3/4	13	(2)	123.50						
22	2	△8 Sides	5/8	5	2 1/2	(1/2)(2)	12.50						
23	2	△8 Sides	5/8	2 5/16	2 9/16	(1/2)(2)	5.91						
24	2	Sides	5/8	5 1/32	17 7/16	(2)	175.11						
25	2	Sides	5/8	3 1/4	11 7/16	(2)	74.34						
26	2	△8 Sides	5/8	3 1/8	3 3/8	(1/2)(2)	10.55	577.73					
27	2	Sides	5/8	1 3/4	11 1/8	(2)	38.94			3	6	1	0	8
28	2	Sides	5/8	1 9/16	10 5/8	(2)	33.20						
29	2	△8 Sides	5/8	3	1 3/4	(1/2)(2)	5.25	39.42					
30	2	△8 Sides	5/8	1 3/4	1/2	(1/2)(2)	.87				2	4	5	8
31	2	Bead	1/4	1 1/4	12 1/8	(2)	30.31						
32	2	Bead	1/4	3/4	39 1/2	(2)	99.25	109.68					
33	2	Bead	1/4	1/2	19 1/2	(2)	19.50				2	7	2	7
34	2	Circular Pad	1/8	(Area) (8" ⌀)	50.27 / 5	(2)	33.51					4	1	9
										1	1	1	3	2	6
					DEDUCTIONS									
A	2	△5 On part #24	5/8	2 1/4	7	(1/2)(2) =	15.75					—	9	8	4
B	1	From #9	1/8	2 1/2	4 3/4		7.88					—	9	8
C		Area fillet 7/8 Rad.= .1604 Area fillet 3/8 Rad.= .0302			= .1342 x (2)x 76						—	2	0	4	0
		Journal Boxes =	105 lbs. x 2 =		210 lbs					1	0	8	2	0	4
		Brake Hanger =	15 1/2 x 2 =		31 lbs									5	8
		Krane =			627.58						6	2	7	5	8
					868.58 lbs.										lbs.

FIG. 5—WORK SHEET FOR COMPILING AND ASSEMBLING INDIVIDUAL WEIGHTS

Journal Box Standard

The journal box is not shown on the layout. Unless it is a special design the weight may be taken from the journal box data book which should be on hand. Experience indicates that estimated journal box weights usually will run lighter by a few pounds than the actual weight of the box when cut off from the frame and weighed. This is due to the tendency of the foundry to depart from drawing dimensions to insure a perfect casting.

For this reason the journal box weights should be determined from actual castings representing what the foundry can do.

As each piece is marked off on the layout it should be entered in pencil on the data sheet as shown. The extending is done at a later stage. When entering the piece involves the use of a data book as illustrated by No. 14 where the area of a ¾-inch radius fillet is involved, the fillet with its radius is entered, but the data book is not used until all entries are made as much time is thereby saved. This also applies to all standard parts where the volume in cublic inches or the weight in pounds is given in the data book.

Checking Small Parts

When a casting has rounded corners it is considered as having the corners square and a correction is made in the deductions as in deduction *C*, where the area of the outside radius is entered in the deductions as plus and from it is deducted the area of the inside radius and this extension which in this case is 0.1342 is multiplied by the number of lineal inches of the frame periphery having the rounded corners and the total multiplied by two because of the two corners.

After all parts on the layout are entered on the estimating sheet, the blueprint should be gone over carefully for parts not required on the layout such as cracking holes, fillets, webs, cores, bosses, etc., and these are marked with a number on the blueprint and entered after scaling for the various dimensions included.

If part No. 2a is noted on the estimating sheet it will be seen that because it is a wedge it is multiplied by ½. It is extremely important that such multiplier fractions for triangles, etc., be enclosed in brackets as shown in the case of No. 2a as only in this way is it possible to avoid the occasional use of the fraction as the part of a whole number preceding it and such mistakes are almost impossible to catch in checking. Moreover without the brackets the fraction ½ following a whole number might easily be mistaken for the ½ multiplier and the latter be left out.

The same method of bracketing must be resorted to in the case of parts occurring twice as No. 2b, No. 3 and No. 4. If the multiplier, 2, is not thus bracketed the checker in looking down the horizontal line to see if the part has been multiplied by two, may encounter the numeral two as used as a dimension and think this the multiplier.

Before extending the figures on the calculating machine, all data from the data book such as areas of fillets, areas of circles, etc., is filled in where required. In the case of the estimate before us the line 14 requiring the area of a fillet of ¾-inch radius would be filled in with 0.12 and the line 34 requiring the area of an 8-inch diameter circle would be entered with the area 50.27. Also the deduction line, C, would be entered with the fillet areas 0.1644 and 0.0302.

Extending Results

The first operation in extending is to encircle as many vertically adjacent factors as is possible such as has been done in groups 2-2a-2b, 3-4, etc. This permits the elimination of many multiplying operations. The extending is then accomplished using two operations in each instance. First the last two figures are multiplied together and the result entered in the second vacant column to the right as in the case of line one. Then this total is multiplied by the fraction in the first column and the total which will be cubic inches is entered at the right hand edge of the sheet, the last two places being decimals.

In the case of a bracketed group, such as lines 2, 2a, 2b, the unbracketed figures are multiplied together and the result set down as shown in the eighth vertical column. These extensions are totaled under the diagonal line and the total multiplied by the bracketed number, the result being entered at the extreme right-hand edge of the sheet as in line one.

It is not necessary that bracketed numbers be directly above or directly under each other and the bracket may be shifted to the right or left to take in any like number in which case the bracket becomes more like a circle around the number indicated and the series of circles is connected with a heavy line.

It is a dangerous practice to try to bracket numbers not in adjacent lines as the intervening line is likely to be skipped.

Also the practice of attempting to so arrange the order of the pieces as taken on the layout so that common dimensions may be grouped in adjacent lines on the estimating sheet is likely to lead to trouble and although such a practice undoubtedly will eliminate many multiplication operations it will at the same time lead to the omission of areas on the drawing.

Checking the Estimate

After all extensions have been made and the total cubic inches determined this sum is multiplied by the factor 0.58 to obtain the weights in pounds.

The factor 0.58 is arrived at in the following manner. The true weight of cast steel has a factor of 0.284, but the rough surface of a steel casting adds some error. Moreover, the amount of metal contained in the fillets too small to be included in an estimate somewhat increases the actual weight over the estimated weight. Another point tending to require a correcting factor is the foundry practice of adding cracking fillets so that in practice it has been found more accurate to substitute for the factor 0.284 the arbitrary factor 0.29 and as only half of the frame is on the drawing this multiplied by two gives the factor 0.58 used.

When the estimate is complete and has been passed on to the other estimator for checking, the estimate should be viewed as if nothing upon it were taken for granted.

Every item on the estimating procedure guide should be brought into question in regard to the estimate and verified.

After this has been done, the layout should be checked for drafting errors. The next step is to verify the drawing as to points where the metal thickness has been indicated and to make certain that all points have been noted where metal thickness changes.

The numbered areas then are followed from the first to the last, rapidly, so that the whole estimate may be carried in mind at one time and repetitions of the same number where used on more than one piece discovered if present. This review should disclose any areas not taken by the estimator who did the calculating.

The checker then proceeds with the detailed checking of each piece, scaling one dimension at a time and checking that off before scaling the next. When an error is found, the incorrect dimension is crossed off on the data sheet and the correct dimension written in as near the old number as possible. The extension is not corrected until later, but the inner and last extensions are crossed off to insure their not being used.

When all the pieces are thus checked and all standard parts taken from the data book are verified, the extensions are checked with a calculating machine. No incorrect figures should be erased. They are merely crossed off and the correct figure written above or below them. In checking extensions with a calculating machine the decimal point is determined by inspection and it is necessary to verify each decimal point.

After the estimate has been checked and all extensions verified and the extension total verified, the estimate should have one more inspection before it is signed and turned in or returned to the estimator for rechecking, in the event mistakes have been found and checked.

Filing the Records

This last inspection consists of verifying the bracketed numbers against the second vertical column to see if all parts taken twice have been so multiplied. After this, the blueprint is reviewed to see if any parts have been left out and the estimate is scanned to see if such things as the journal box weight and the brake hanger weight have been omitted. Then the final weight is considered in the light of what a frame of the design in question should be expected to weigh and if the weight seems reasonable, the checker has done everything that he can to insure an accurate weight.

The weight card for the estimating department file is filled out by the estimator as shown in Fig. 1, which appeared in the May 1 installment and this the checker verifies, making certain that the issue letter in particular is correct and where corrections are made in the estimator's weight, the old figure is crossed out, not erased, and the corrected weight entered. The dating of all estimates and the signing of them is important from the standpoint of future reference to the sheet or the card, as any change in estimating department personnel leaves the estimates checked by the new estimator somewhat in question for the first few months of his employment and this

is taken into account in the use of such estimates for subsequent bases.

The estimating sheet shown in Fig. 3 always is made in duplicate through the use of carbon paper and the carbon copy is not separated until the estimate is checked and the checked changes ratified by the original estimator. If, as sometimes happens, the carbon copy is illegible as to the changes made upon it, the original may generally be borrowed from the files when its use becomes necessary for estimates requiring it.

The carbon copies are filed numerically according to the number of the drawing they represent. The fact that different customers may send in drawings of the same number will cause no confusion, as the name of the customer is written at the top of the sheet.

The filing of the layout is important and it should have the drawing number with full notations of any changes in it, made for use in estimates other than the original estimate. Thus, if a layout is subsequently used to assist in the estimate of a later issue by difference where additional lines are added to the layout the notation should indicate clearly that this has been done and the new lines should be indicated.

The filing of the layout blueprint is the same as the procedure for the layout and they should be kept together. This quickly becomes a problem as one print may in time become the base for a number of estimates, all having the original pattern base and as the tendency is to file the base print with the last blueprint with which it is used as a base, a search of the file for a given print is often fruitless unless all the drawing numbers having the common pattern base are looked up and the file in each case investigated. All this may be avoided if a flag in the form of a sheet of paper is filed in the place where any print has been removed giving the number of the drawing with which the print will be used. The base then may be filed with the last print with which it is associated.

When a print is so used carefully made notations must appear upon the print, giving the status of all marks made upon it and such markings should be in different colors for each use of the print. The impossibility of getting additional prints after the tracing has been brought to a later issue makes it always advisable to confine print check marks to the issues where additional prints are obtainable in cases where this is possible.

An essential record of a weight estimating department is a journal or diary which should be kept in a bound book, not upon loose leaves. The journal should contain a consecutive record of all estimating work brought to the department. The order of entry being the order in which the work is brought to the department.

A stenographer's notebook will suffice and only one of the two pages visible on opening the book is used for the record. The other is reserved for notes relative to the status of the work passing through the department. Thus only is it possible to insure the keeping of important data relative to the weight files where it may be found when needed and where it cannot be overlooked by the estimator as occurs when his notes are on pieces of paper laid away for future use. Such a book makes it possible during the course of the routine work to collect references relative to particular estimates where additional attention is desirable but impossible at the time the estimate was made. It serves to record the location of data that later may be required in the estimating weight detail catalog and it is an invaluable record of *hunches* as to possibly erroneous pattern weights that come under suspicion in the routine handling of old records, but which cannot be investigated at the moment.

International Committee Meets in Barcelona

The International Committee of Foundry Associations held its meeting on Friday, April 13, during the Barcelona convention, Barcelona, Spain. Dr. Geilenkirchen acted as chairman in the place of Dr. Werner who was unable to attend, and who represented the German associations. Dr. Werner, president, Verein Deutscher Eisengiessereien, is chairman of the committee for the current year. Great Britain was represented by V. C. Faulkner, past president, Institute of British Foundrymen; France by H. Magdalenat, vice president, French organization; Belgium by Jean Lamoureux, vice president Belgian association; Spain by J. M. Espana; Italy by Com. Ing. Vanzetti; Czecho-Slovakia by Prof. Pisek; Holland by Dr. Dresden. The American Foundrymen's association was represented by V. Delport, European member of international relations. T. Mackemson, secretary, Institute of British Foundrymen acted as honorary secretary.

At the meeting, the Dutch association formally was received as a member. Preliminary arrangements then were made concerning the third international foundry congress to be held in London, England, in June 1929, and at which it is expected that an American delegation will officially represent the American Foundrymen's association. A discussion took place relating to a dictionary of foundry terms in several languages, to which the committee has given its moral support. It was decided that a list of French terms would be prepared, with the definition of each term. Each term is to have a reference number. This would constitute the dictionary of French terms. The other countries each would prepare a dictionary on the same lines, and the reference numbers would enable any word to be found with its definition in one language or another. It was decided in principle that the publishing of the dictionary would be handled by a private concern. The proposition is to be discussed by the various foundry associations.

At the end of the meeting a resolution was passed according to which the committee recommends that when exchange papers are to be presented at a convention, the date of this convention should be made known to the associations presenting the papers as soon as possible, and that the authors of the exchange papers should be asked to prepare the paper with sufficient time to enable the translation and printing to be carried out before the congress at which the paper is to be read. The date of the next meeting was fixed for June 1929, in London where the next international congress will take place.

Receives Important Contracts

Brightside Foundry & Engineering Co. Ltd., Sheffield, England, recently has received two important contracts. One contract is to erect and supply all the cast-iron circulating mains, high pressure steam pipes and fittings (275 pounds per square inch), and all exhaust and feed pipes for a new electric generating station at Oldham. The contract price is over $121,500. The other contract is for complete heating and hot water service for the Mickleover asylum, Derby county. The contract price for this is $47,-263. Similar installations have been contracted for by the Dewsbury new infirmary and by the Harton board of guardians, the price being $111,-780.

W. R. Bean, president, Grindle Fuel Equipment Co., Harvey, Ill., addressed the Philadelphia Foundrymen's association at a meeting held April 16 at the Fort Pitt hotel on "Metallurgical Problems in the Malleable Iron Foundry."

The FOUNDRY Family Photograph Album

Upper Left

C. S. NEUMANN
Union Mfg. Co.,
New Britain, Conn.

Lower Left

H. J. O'NEIL
Western Foundry
Co., Chicago

Upper Right

E. E. KLOOZ
Portage Silica Co.,
Youngstown, O.

Lower Right

J. W. OLIVER
Standard Sanitary
Mfg. Co.,
Pittsburgh

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

A LEXICON OF TECHNICAL TERMS

By O. W. Potter

(*Continued from Data Sheet No.* 714)

Growth Property

The property to permanently increase dimensions when subjected to intermittent heating and cooling.

Wrought iron, malleable iron, steel, and white iron do not grow. Gray cast iron grows extensively.

This growth property is an important factor to be taken into consideration in gray cast iron which must be machined and then subjected to intermittent high and low temperatures. The limit of growth is not known and its cause is not understood definitely. It has made necessary the use of steel in the place of cast iron in many cases.

Breaking Down Temperature

The temperature at which a cutting tool no longer retains its cutting edge. Between 843-927 degrees Cent. (1550-1700 degrees Fahr.) for ordinary tool steel.

Red Hardness

The property of not losing an edge when the cutting edge of a tool steel becomes red hot. Certain alloy tool steels which exhibit this property are sometimes called self-hardening. Tool steels of following composition are red hard:

Element	Per Cent
Tungsten	3.4 -24.0
Chromium	0.0 - 6.0
Carbon	0.4 - 2.19
Silicon	0.21- 3.00

Critical Cooling Velocity

The rate of cooling which must be maintained if self-hardening is to result. This refers particularly to tool steel, especially tungsten steels.

Critical Velocity of Quench

The rate of quenching which is required to produce hardness. This varies with every different alloy and composition. Steels of the eutectoid composition (0.9 per cent carbon) require less drastic quenching than other steels.

Quenching Temperature

This is understood to be the temperature to which an object is heated before quenching. This varies with the results required, chemical composition, quenching media, etc. It is usually within the critical range of the alloy.

(*Continued on Data Sheet No.* 718)

A LEXICON OF TECHNICAL TERMS

(*Continued from Data Sheet No.* 717)

Fluidity (Life)

The property to flow easily.

Examples:

1. Wrought iron is not sufficiently fluid for casting.
2. Other alloys of this series are all sufficiently fluid for casting; those with the lower melting point being the most fluid; for example, gray cast iron is most fluid.
3. Oxidized and improperly melted metal reduces the fluidity.
4. Phosphorus, silicon, aluminum and lead aid fluidity in the order named.

A molten mass is said to have *life* when it is readily fluid.

Critical Mechanical Temperature

That temperature at which steel has the maximum ductility. For ordinary carbon steels this ranges from 80 to 120 degrees Cent.

Electrical Conductivity

Electrical conductivity is the reciprocal of specific resistance

$$V = \frac{1}{S \times R}$$

Conductivities of some metals follow:

Pure iron	0.11
Mild steel	0.08
Wrought iron	0.07
Malleable iron	0.031
White cast iron	0.017
Gray cast iron	0.0095

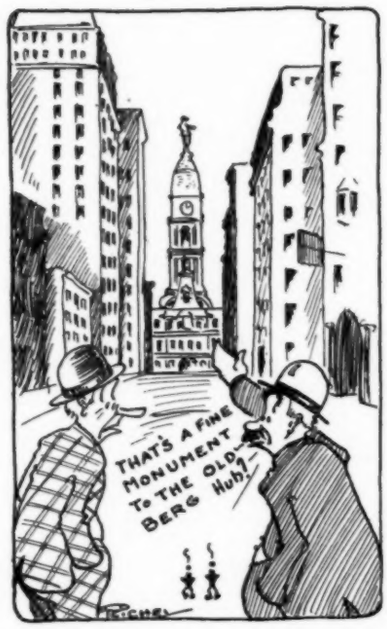
Magnetic Permeability

The ease with which lines of magnetism pass through a substance. It is sometimes called *electrical permeability*. It is expressed as the ratio of the number of magnetic lines in the material to the number of magnetic lines in air per unit area.

$$Mu = \frac{B}{H}$$

B=the number of magnetic lines per unit cross section.
H=the number of lines of force per unit area in air.

(*Continued on Data Sheet No.* 719)



Bill Touches Upon Some Molding Problems—V

By Pat Dwyer

EVERY year about this time I am confronted by the job of sticking the screen doors up in the same position from which I removed them the preceding fall. Each time before I take them down I remark to all and sundry who care to listen, that the job is unnecessary. I advance a logical and carefully thought out argument to the effect that it is a waste of time and energy. I point out that no more effort is required to open and close a screen door in winter than in summer. Therefore why not leave the doors as they are? This argument is followed by one that is, or should be, still more convincing to wit, viz: What is the use of taking them down when, most assuredly, I will have to put them back in place in a few months?

Experience gained over a period of many years should convince me of the futility—there, I knew that word would slip past me some day—of setting up an argument, however logical, against established custom and tradition. Nothing but the good old virtue of Hope that springs eternal in the human breast prompts me to try again. Who knows? Perhaps some day virtue and truth will triumph and I can leave the doors there until they fall off. Then I will replace them. That admission should convince any reasonable person that I am willing to meet any proposition half way.

On several occasions in the same reasonable spirit I have offered to compromise. To save the bother of opening and shutting them during the winter I have offered to attach a hook to each door and fasten it back to a staple or a screw-eye in the wall.

This sensible and friendly offer has been turned down flat. The incident merely is another example of how our best meant intentions are misunderstood and unappreciated. A prophet is not without honor and so forth. I have been accused of quibbling, of laziness, of a craven desire to dodge legitimate responsibility.

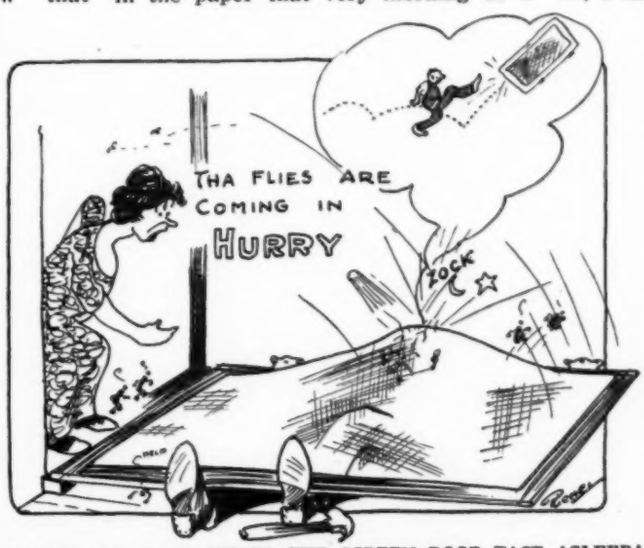
Fortified by a pure and sterling conscience I can deny these gross and unwarranted charges singly and in toto, but when the party of the second part says resignedly to never mind, she will do the job herself, I capitulate and chalk up one more unconditional surrender on the long list.

Taking down the doors is bad enough. Usually through one cause and another, entirely beyond my control, the job is postponed until some bitterly cold Saturday afternoon. After the modest noon day repast I remark casually that winter appears to be here in earnest and how fortunate we are in having a nice, warm house in which to spend a few leisure hours. No right minded person would think of turning even a dog out in weather like this. I remember reading in the paper that very morning of a man, never sick before, caught a cold that turned to pneumonia, whipped him off in a couple of days, just like that!

Where does this homeless dog and pneumonia stuff get me? No place, just simply no place, so far as my good intention is concerned. To the accompaniment of numbed fingers and chattering teeth and a mental malediction on wood screws anchored as tight and solid as teeth in a crosscut saw or the axles in railroad car wheels, the doors finally are removed and dragged down into the cellar.

A somewhat new set of conditions arises when the time comes to hang them again in the spring. After the usual preliminary skirmish extending over a few weeks I carry the doors up from the cellar alone and unaided and prop them in position. No person steps forward gallantly and says, "Here, let me carry those—or even one of those doors—up for you." I am even denied the pleasure and consolation of an audience standing around in respectful admiration while I stage the skilful and herculean exhibition. The only encouragement I receive is a brief admonition from an audience of one, for heaven's sake to make it snappy, and use the side door instead of tracking back and forth from the front to the back.

A man of neat and methodical habits, I invariably wrap the screws in a twist of paper and lay them close to the doors. Also invariably when I resurrect the wretched things in the spring I find that the screws have disappeared. The fiendish ability displayed by inanimate objects to take wings and fly away is a subject over which I have pondered many times. Natural and justifiable suspicion leads me to subject one young shack building hero to a gruelling cross examination, but he has a perfect alibi in an old tin can containing a quantity of rusty nails left over after the edifice was completed. His mother comes to the rescue



LITTLE BOY BLUE UNDER THE SCREEN DOOR FAST ASLEEP!

by declaring that I either forgot to pack the screws away, or, that I hid them in some inaccessible place and now cannot remember where it is. Now, is that nice?

This year presented no exception to others that have gone before. When I discovered that the screws were missing I announced boldly that I would not hang the doors until I found them. If necessary I would devote the entire summer to the task. I would turn the cellar inside out. In making this heroic announcement I fully realized that I was pledging many precious hours that might be devoted to rest and innocent recreation, but a principle or something was at stake and I felt that no sacrifice was too great. A sacrifice of some kind usually is involved where principal—and interest—are concerned.

"You can suit yourself," quoth the lady, "in poking around the cellar for the remainder of the summer. You will be out of the way and I will be saved the trouble of sweeping up ashes and burned matches. However, before you sink out of sight and start on your useless submarine quest, put on your coat and dash up to the local hardware store for a set of screws for the door hinges. You have wasted enough time prating, to have hung half a dozen doors. On your way. Hop to it. Don't get into an argument with the store keeper or with any of the bums loafing at the corner and don't forget what you went after. If you come home with a dog collar or a rat trap I'll—I'll—"

"Oh sure," I interrupted, "You'll ask me to wear one and stick my fingers in the other. Don't worry. When I go shopping I know exactly what I want. I go into a store, make my purchase and—"

"Yes," said she, "I have seen you many times. You walk into a store, make a purchase and then walk out again after leaving the article lying on the counter. I suppose you have forgotten the last time you bought a new hat. One of the clerks had to chase you half a block to present you with the old one. If I live to be a hundred I'll never forget my humiliation the time the waiter in the hotel dining room had to remind you that you had forgotten to pay the dinner check. Do you remember—"

I grabbed my coat and fled. Essentially a man of peace I hate to get mixed up in arguments with people who insist on dwelling on inconsequential details and who bring up trifling incidents long since past and gone. It is only a waste of time, the most precious of all commodities. I was brought up in a frugal atmosphere where every minute had to be turned to the best account. The jolly old bee has been my emblem.

Consider the busy little bee,
He certainly is a wow.
He sharpens the good old stingaree
And grabs the stuff, and how!

Nothing of any consequence happened on my journey to and from the hardware store. I dropped the package of screws in my coat pocket and the honest young clerk called me back before I reached the door to give me my change. This friendly and spontaneous demonstration went a long way to restoring my faith in the much maligned younger generation. Give them an even break and they are fundamentally sound. If the amount had been worth while perhaps—.

JOHNNY COMES MARCHING HOME AGAIN

Back again at the old homestead I adjusted one of the doors in place and reached into my coat pocket for the screws. Here's where you say to yourself, "Ha, ha! Four bits to nothing they were missing!"

Friend, you would lose your money. I found the set of screws which I had taken out of the door the preceding fall. I have no explanation to offer for this phenomenon. It simply is another item added to the long list of mysteries connected with the movement of inanimate objects. Next fall, when and if I take down the doors I deliberately shall throw the screws in the garbage can. The following spring I shall not be surprised in the least to find them tied up in a strand of rabbit snare wire and hanging from one of the door hinges.

Flushed with the consciousness of a major piece of work well done I reported modestly to headquarters that I guessed I was through for the day.

"Guess again," said the lady. "You are only half through. I want you to hang up the porch swing and then I have a few other little jobs laid out to round out the day."

Fortunately, Bill came prowling around a few minutes afterward and gave me a hand with the swing. He is a handy lad on jobs of that kind and I generously allowed him to adjust the swing to his liking. Hanging a swing is only half the battle. It must be tested out under working conditions to adjust any little discrepancies in balance and motion. We sat down comfortably to enjoy the pipe of peace and let the rest of the world go by.

"Well," said Bill, "a week from next Monday we'll land in Philadelphia with the biggest and most gorgeous crowd of foundrymen ever gathered together at one time in one place. I see by the program that great doings are projected for every day and every night. Only one feature has been omitted."

"You have a better eye than I have, Bunco Tim," I replied. "I have looked over the program and I only wonder how it can be compressed into four days."

"Well," said Bill, "I'll tell you. To start the thing off with a bang I should like to see the boys lined up four abreast the first day and marching out to the museum with a rousing band at the head and tail and with a few more sandwiched in about three blocks apart. Let the people know we are in town, ready to take it apart and see what makes it tick."

"The idea," I admitted, "has its fine points and reflects great credit on your original inventive faculty, but you have overlooked one point. Trifling it is true, but one that I am afraid would prove embarrassing. Outside a few horny hoofed individuals like yourself, you could not coax, persuade or even bribe any person to march that distance through crowded city streets. You can count me out right now. In the regular course of events I expect to walk at least 211 miles during the four days and nights we are in the city and that is enough for any ordinary human being."

"With your gift of imagination," said Bill, "you should be writing fiction instead of working for a living.

I'll lay you odds of 7 to 1 in any amount up to 4 bits that if you attach a speedometer to one of your bandy legs it won't register a total of 10 miles for the week. Half of that distance will represent exploring trips for out of the way eating houses and most of the remainder will be consumed into and out of taxi cabs.

"You should welcome the opportunity of taking long walks, of stretching the legs, of filling the lungs with great drafts of the life giving ozone. You keep on at the rate you are going and the first thing you know the old dogs will quit cold on you some day. You will have to hire a boy to push you around in a wheel chair."

"Bill," I said, "if you were a reasonable human being, which you are not, I would present 47 arguments to prove that you and all the other exercise sharks are wrong. Who die, who are crippled, who are all in at 50? The famous athletes, my lad! Ordinary common sense, if you had any, should tell you that a man who takes care of his feet will have the use of them longer than the man who continually pounds the life out of them. Remember what Poor Richard said: Take care of your dogs and your dogs will take care of you."

"Poor Richard?" said Bill. "Oh! You mean the almanac guy. He seemed to know something about nearly everything. I wonder if he knew anything about the foundry business. If he did I should like to have his comment on the best way of molding the water trough I was discussing the last time I was over here. One foundryman I knew had been making them in a plain open sand mold, but the customer wanted a smooth, finished surface on the casting.

"The foundryman has the choice of: (1) Lifting the cheek away and leaving the core undisturbed. (2) Lifting the core out of the mold after the pattern has been removed. (3) Leave the outside part of the mold undisturbed and lower core into it. The core may be made in one piece or in several sections in an independent corebox. The sections are assembled outside and lowered into the mold as a unit, or are assembled as in the mold. In the first instance the joints may be slicked over to present a uniform surface. In the second, each of the seams must be chipped on the casting to show a uniform, straight face.

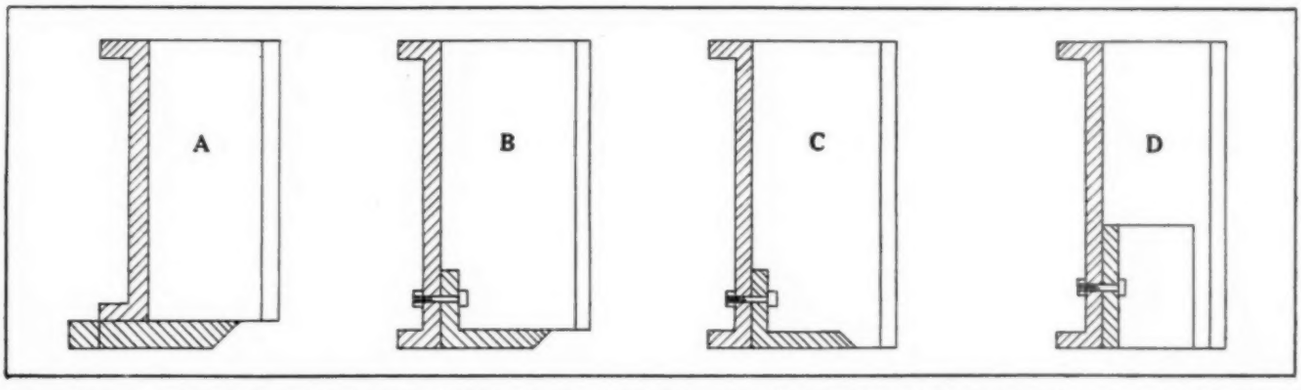
"In some instances the foundryman has a free choice, while in others local conditions may confine him to one. Thus if he has a suitable flask available he will adopt the first method. If he has no flask he will adopt the second, because it is cheaper to make a lifting plate for the core than it is to make a flask for the cheek. If the floor of his foundry is of such character that he cannot dig a pit, then he has to make a flask for the outside of the mold, because he has no other alternative. Making the core separately will appeal to some men on account of the insurance afforded. A dry sand core either in one piece or in sections does not require anywhere near the care and skill required to ram a green sand core.

"Even in the three methods mentioned variation may be introduced in some of the detail of construction and operation. At least four methods are available for carrying the sand in the cheek and even these four methods may be varied to the extent of substituting crabs or arbors for plain plates. In the first method a heavy plate is employed, designed to carry all the weight of the sand. It is provided with lugs on the outside to be engaged by available chains or slings suspended from an equalizer beam attached to the crane hook. The purpose of the beam is to prevent the chains from squeezing the sides of the flask when the lifting strain is applied. This precaution is specially necessary with wood flasks, but an apparently stiff iron or steel flask, 12 feet in length and without any transverse bracing, will spring to an astonishing degree under heavy pressure.

"On account of the thickness of this plate it is advisable to make the bottom parting as shown at *A* with the top surface of the plate flush with the bottom edge of the pattern. A suitable scraper with a shoulder riding on top of the pattern for a guide is employed to form a rough seat for the plate. The plate then is rapped down to a bearing. The space between the beveled edge of the plate and the pattern is packed with sand and a parting is made with the trowel from the bottom outside edge of the pattern to the upper inside edge of the plate. This method of fitting the plate to the parting is preferable to that sometimes practised where the beveled parting first is made by guess or with a scraper and then covered with parting sand before the plate is lowered into place. The first method requires far less time than the second and—what is more important—insures a more intimate fit.

"The only difference between the lifting plates shown at *B* and *C* is that *B* is beveled along the inner edge to fit a depressed parting similar to that shown at *A*, while the edge of *C* is beveled in the opposite direction so that the plate may rest on a plain flat parting surface flush with the bottom edge of the pattern. These two plates differ from the plate shown at *A* in that they are comparatively light and are bolted to the inner, lower edge of the cheek flask through suitable lugs. Another advantage of this style of plate is that it may be cast in short standard lengths and thus be available any time to fit up flasks of various sizes. The style

(*Concluded on Page* 405)



ILLUSTRATING ALTERNATIVE METHODS OF MAKING THE PARTI NG LINE AT THE BOTTOM OF THE PATTERN AND OF ADJUSTING A LIFTING PLATE TO CARRY THE SAN D ON THE OUTSIDE OF THE PATTERN

How and Why in Brass Founding

By Charles Vickers

Brass Castings Crack

We are having considerable trouble with yellow brass castings which are barrel-shaped bands one inch or more wide according to the size, and having four eye lugs cast on the sides at equal distances. The alloy used consists of 54 pounds of copper and 46 pounds of galvanizer's dross with a little aluminum for fluidity. The difficulty shapes up as dirt in the castings and cracks at the juncture of the lugs with the band body, and invariably these are much worse near the gates. We wonder whether the small amount of lead the alloy contains is the cause of the loss. We formerly thought it was due to shrinkage but after putting shrink balls on top of the edge of the band at the juncture of the lugs we got no better results. The metal is electrically melted and well mixed as the furnace continually rocks. We shall appreciate your suggestions.

The method of gating is the cause of the trouble. The sample castings sent to us show that the gates are cut into the band itself between any couple of lugs. The band being barrel-shaped has to be parted midway where the metal is thickest, but even there it is not more than $\frac{3}{16}$-inch thick. In the case of a red brass the bands would come alright as there is a distinction between aluminized yellow brass and clean red brass, and the distinction is that the red brass flows without foaming; in short like clean water, whereas the aluminized metal runs like soapy water. This means that it lathers and forms a foam. The aluminum makes the metal sufficiently glutinous so when agitated it takes up air. As the air contains oxygen, it is unavoidable that the alloy gets oxidized as well as lathered. The oxidized metal forms the drossy cracked fractures, as some of the air is squeezed out on solidification of the metal, so the band itself at the drossy point is split vertically and centrally, and also some of the air gets to the adjacent lug junctures as there the metal being thicker stays hot longest.

The problem is the gates. How should they be attached so the metal will flow gently and quietly into the mold to form the castings? Evidently the band gate is no good as the metal cannot pass around the narrow band space as fast as it is pushed against the inner sand wall, it is deflected back against the incoming stream producing great agitation at this point. It may be that several methods of gating will have to be tried until the one producing best results is discovered. As inventive ability is a valuable possession for brass foundry workers, here is a chance for them to exercise their talents.

When To Clean Pots

We would like to be advised whether it is desirable to scrape or clean the insides of iron pots or crucibles used for melting an aluminum alloy of approximately aluminum, 90 parts; copper, 10 parts; magnesium, ½ part. We have been under the impression that the general practice is to melt for one complete day and scrape and clean the pots before they are used the next day. We also find that some foundries prefer to clean their pots after each heat has been dumped.

Some people put themselves to a lot of trouble that to others seems unnecessary, but no doubt they consider cleaning after every heat to be advisable. However, the practice slows up production and would never be practised in a busy place. Also the practice of emptying the pot and dividing the melting period into *heats* reduces the output of liquid metal per day and the amount of metal melted by the pot during its life. When a bath of metal is left in the pot it acts to prevent the bottom getting unduly heated on refilling with cold metal the second time. Also the liquid metal washes down the solid additions, but on the start the latter should never be added in such amount as to freeze the bath. Keep the latter liquid and as the pool grows the charging can be done in larger amounts. Using such methods when melting it would not be possible to clean and scrape out the pot more than once a day, and we are unable to see any necessity for such frequent cleaning out. Some casters limewash the insides of their pots every morning and the lime acts as a parting and makes it more easy to detach the skull of metal that may form as the pot is being emptied. It is not necessary to empty the pot to do this work, however, if it is felt that it should be done.

Shrinkage Makes Cracks

We are making some aluminum covers circular in shape, with one flat side which reduces the diameter of 19½ inches to 15¼ inches across the clipped portion. On one side a flange is carried like that on a pill box lid, and across the disk there are ribs which carry double the metal in the thickness of the main casting. We are having considerable trouble with this casting checking away from the ribs. The alloy is 50 per cent new No. 12 and 50 per cent crank case scrap. Can we avoid this trouble without changing the design of the ribs? Also can we whiten the castings to remove the scorched spots near the gates?

With the exception of the ribs the metal is quite uniform in thickness, being one eighth of an inch, but the gate does not connect in any way with the ribbed parts. The metal, as it enters the mold crosses a flat, thin part, the widest thin part of the cast. ing. The thin sections congeal before the ribbed parts and draw away from them producing the cracks, which are shrinkage cracks. There is a possibility then, of surmounting the difficulty by changing the gates, and the best place to change them would be to the side opposite the flat side, because there the gates would connect right into the ends of the flanges. The flasks may, of course be too narrow to permit of this change and that the gates would have to be as at present. The only change in that case possible would be to cast the covers *the other way up.* That is with the ribbed and flanged surface in the cope. As molds for flat, thin plates such as these castings cannot be rolled over for pouring with safety, it would be necessary to mold the pattern with the flanged surface in the cope. This can be done with a little rigging and probable changing of the pattern. Thus the draft of the small hole in the center would have to be changed. The flange also might require a little stronger taper, but in these days of vibrators we do not consider it a difficult job to mold the castings, flange upwards. In the days of *rap with yer knee* it was not so easy. To change the metal would increase the expense of the castings considerably as the scrap would have to be discarded.

Cleaning Room Progress Aids Production of Quality Castings

By Frank G. Steinebach

Part VI

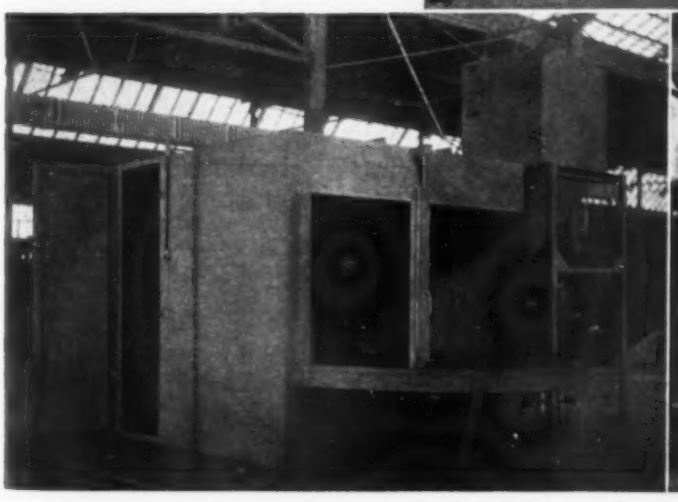
MANY of the cleaning room problems, which confronted the foundryman a quarter of a century ago, have been solved through the application of various types of sandblast equipment now on the market. The lethargy manifested by American manufacturers in that period following the introduction of the sandblast process has disappeared entirely and today equipment builders in the United States leac the world in the development and perfection of sandblast machines and auxiliary equipment.

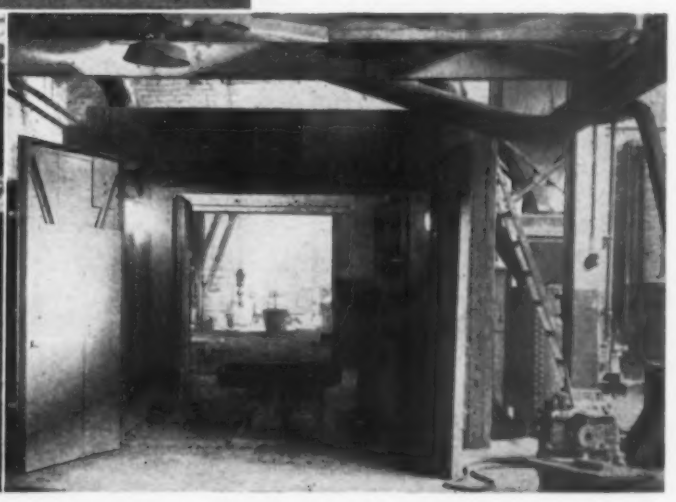
While one of the first applications of the sandblast process was in the cleaning department of a foundry and much of the development that has taken place has concerned primarily equipment for foundry work, it is interesting to note that the process has found many new applications. In addition to its foundry applications, the use of the sandblast ranges from the cleaning of automobile bodies, buildings, steel cars, ships hulls, etc., to frosting and ornamenting glass, lettering or carving monuments and finishing jewelry.

Modern sandblast equipment produces an exceedingly fine finish on either ferrous or nonferrous castings, performing the work in a remarkably short period of time. Surfaces which must be painted, enameled, lacquered, plated, galvanized or otherwise treated, may be cleaned and prepared quickly and economically by the sandblast method. The sandblast also preserves all delicate outlines and sharp edges, such as are encountered in ornamental castings. That equipment also

Fig. 51 (Below)—This Type of Room Is Constructed Without a Pit. The Used Abrasive Falls Through the Gratings in the Turntable and then Is Carried to the Separator and Pressure Tank on the Side of the Room. Fig. 52 (Right)—Down Draft Ventilation Is Used in this Type of Room

Fig. 53 (Below)—An Interesting View Showing the Method of Ventilating the Room with the Air Entering Through Slots in the Roof and Leaving through the Ducts Shown Near the Floor. The Room Is Built Between the Foundry and Finishing Department, and the Work Is Brought Directly from the Molding Floor, Shown in the Distance





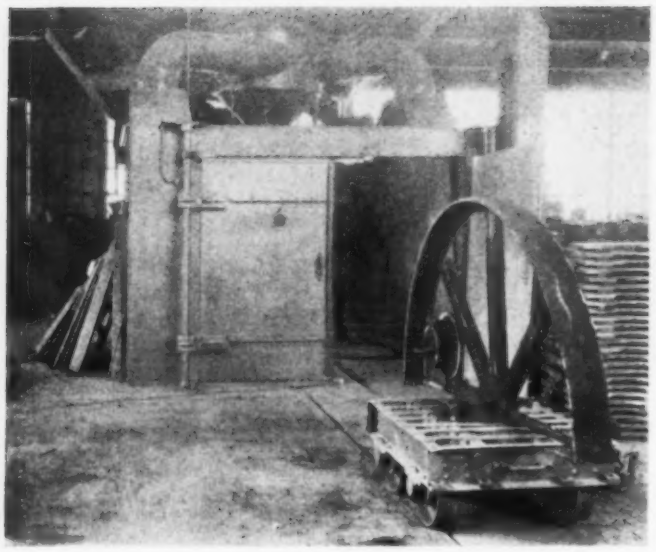


Fig. 54—A Variety of Methods May Be Used To Carry the Work Inside of the Room. In This Installation the Room Is Equipped with a Turntable and Industrial Car Tracks

has found extensive use in cleaning steel castings, especially in removing the burned sand which clings to the surface of the casting.

Sandblast equipment may be classified under two general types, namely gravity and pressure. In the gravity type machine, the sand is propelled by a jet of air which strikes the sand as it feeds downward by gravity. Generally the gravity feed is visible and the amount of sand fed can be controlled readily by the operator. In the pressure type the abrasive is contained in a steel tank under pressure. The abrasive travels from the tank to the discharge nozzle under pressure, thus permitting the use of higher air pressures than in the gravity type.

The various types of sandblast equipment applicable to the foundry industry are as follows: Sandblast rooms, sandblast barrels, rotary sandblast tables, sandblast cabinets, and in some cases portable machines. Since the first sandblasting was performed in some type of a room, principally to confine the dust and dirt arising from the operation, and the various classifications of equipment have been developed from the original room idea, the modern sandblast room now in use in foundries throughout the world will be first discussed in this article.

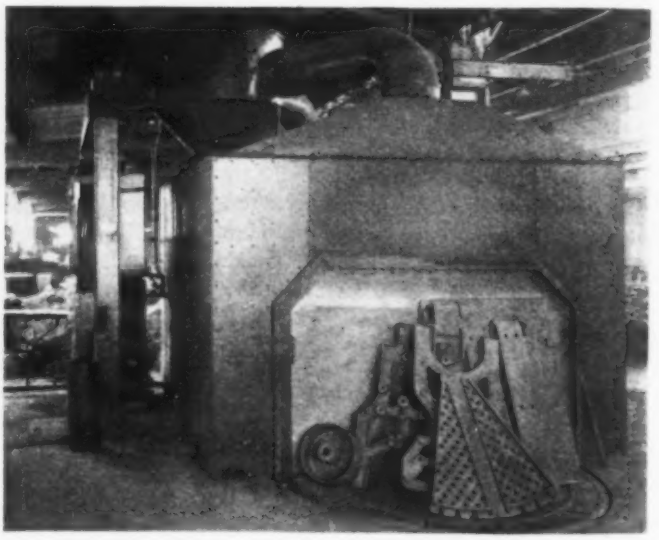


Fig. 56—Side View of the Same Room Shown in Fig. 54. This View Shows the Turntable and the Method of Loading

Sandblast rooms today are designed primarily to handle large work of a character which would be difficult to clean on such equipment as the sandblast barrel, the rotary table or the sandblast cabinet. However, the scope of the room type equipment is not limited to the larger work and the machine may be used to clean any class of castings which the occasion may demand. While certain points of similarity may be noted in the sandblast rooms built by various manufacturers, many of the important features of design differ radically. For that reason a more or less detailed description of the leading types should be of interest.

One type of sandblast room is constructed of heavy steel panels fastened in place by heavy clamps. The lower inside portion of the room is designed with multiple liners to protect the sheet housing from the action of the sand. Fillet corners are used to eliminate all ledges and corners where dust might collect. The room is illuminated by electric bulbs mounted in a fixture and enclosed in heavy glass globes. The floor is constructed of flat steel bars assembled on edge with through tie bars and spacers. The floor is built in sections so that a portion of the floor may be removed when necessary. A perforated plate floor also may be used in this room, as shown in Fig. 52.

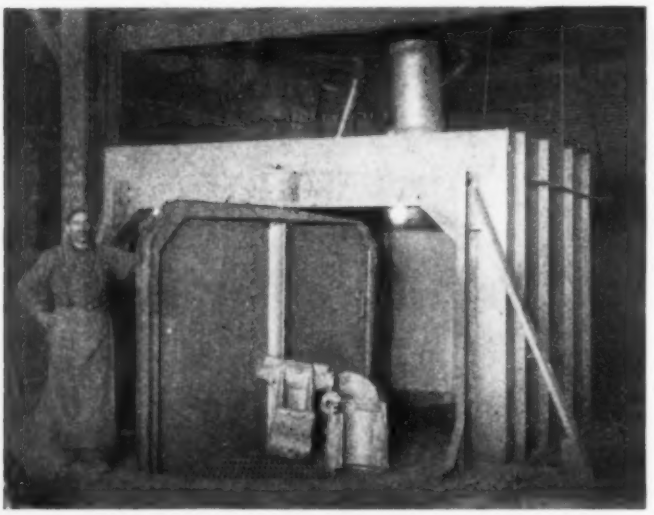


Fig. 55—An Interesting Example of a Room Equipped with a Turntable Large Enough To Handle Large Work.

The down-blast system of ventilation is used. The roof of the room is constructed with a series of baffles which are so arranged that air may enter uniformily over the roof. However, no abrasive can escape through the openings in the ceiling. The air passes downward through the room, carrying the dust with it, and then passes through the floor gratings or through a 3-inch opening at the floor line on two sides of the room.

Equipment which cleans the spent abrasive, the pressure tank and the return blast line all are located in a

pit immediately below the room. The dust laden air and spent abrasive enter a hopper after passing through the floor gratings. This hopper tapers to a horizontal screen placed immediately above the pressure tank. The shape of the hopper increases the downward velocity of the air and a sudden change in the direction in which the air moves causes the fine dust and particles of dust to be carried along with the air. The usable abrasive is collected by the conical hopper and the nails, wires, gaggers and other foreign material are retained on a screen covering the top of the hopper.

The hopper, in which the cleaned sand is collected, is located immediately above the pressure tank. When the air pressure in the tank is relieved, an automatic filling valve in the head of the tank opens and allows the sand to flow by gravity into the pressure tank. The entire mechanism

Fig. 58—A Battery of Sandblast Rooms Equipped With a Special Type of Turntable

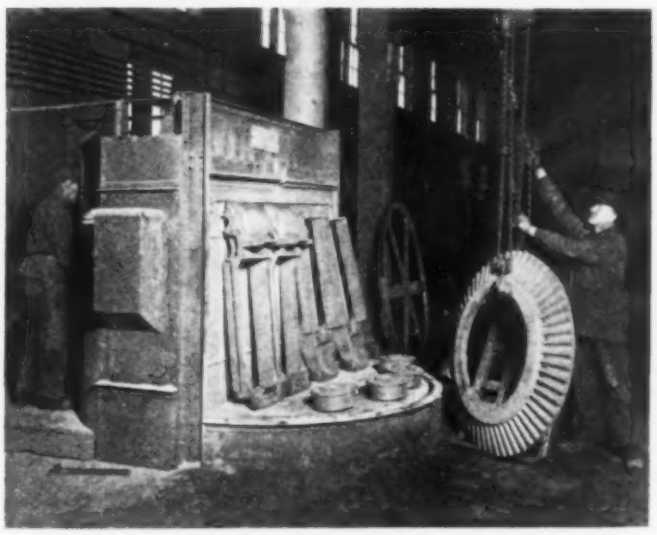


Fig. 57—A Turntable Room Designed so that the Operator Stands Outside of the Room While Directing the Blast

is controlled pneumatically by a valve located on the inside of the room. In this type of room the operator is located on the inside of the room and directs the stream of abrasive against the work to be cleaned through a rubber hose and a nozzle.

The same company also makes a sandblast room so designed that the operator stands on the outside of the room to direct the abrasive stream. The construction of this type of room is much of the same as the one previously described. The room is provided with vision screens and a nozzle slot the entire length of one side of the room. In some cases where considered desirable, the screens and the slot extend along two sides of the room. The slot is protected by a double slit rubber curtain. The observation screens are removable sash covered with a fine meshed wire screen cloth. The housing, floor grating, the abrasive recovery equipment and the controls on this machine are the same as on the regular room type sandblast. The angle plate roof construction is not used since a sufficient amount of air enters the observation screens to ventilate the room properly. A room of this type equipped with a turntable is shown in Fig. 57.

Either type of room also may be equipped with a rotary table, shown in Fig. 55, which greatly reduces the time necessary for loading. This table is divided into two sections by a steel partition, so that a laborer outside of the room may unload the finished work and load the dirty castings on the table while the operator is blasting a load of castings on the inside of the room. Rotary tables, which may be built flush with the floor or at standard heights above the floor level, are constructed of sections built of steel bars bolted together. The table turns easily since it is mounted on ball bearings with roller bearings at both the top and the bottom. Either sand, chilled shot or steel grit may be used.

Three types of sandblast rooms, classified according to the method employed in handling the abrasive material, are manufactured by another company. This equipment may be built with a pneumatic sand elevating system, a gravity feed into the sandblast machine or a mechanical elevator which carries the spent abrasive to the

Fig. 59—A Downdraft Room Equipped With Perforated Plate Floor Gratings and a Turntable

sandblast machine on the floor level. In the pneumatic type, the abrasive material falls through a grating in the floor of the room and is fed by gravity into an elevating pipe connected to the bottom of the hopper. This pipe also acts as one of the ventilating ducts, as the end of the pipe protrudes through the hopper into the lower part of the room, and draws the abrasive and dust up to the separator, which is located along one side of the room. The separator is built of fabricated steel plate and is provided with baffle plates to break the current of air and retard and collect the abrasive. Cleaned abrasive is discharged directly into the sandblast

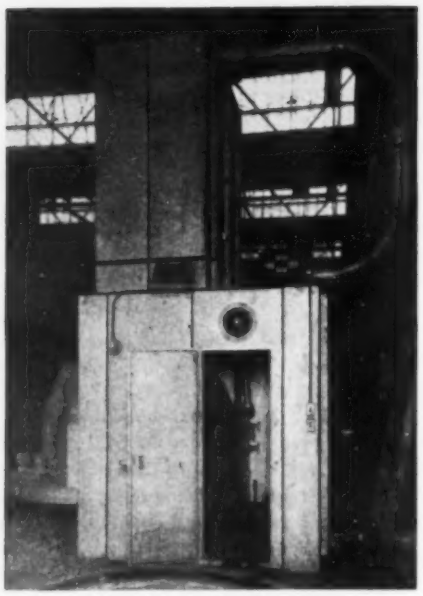


FIG. 60—EXAMPLE OF THE SIDE DRAFT METHOD OF VENTILATION

machine through discharge pipes equipped with unloading valves.

In the gravity type machine, the sand falls through the grating in the floor of the room, through a screen and into the hopper directly above the sandblast machine. The sandblast machine is in a pit below the room. In the mechanical elevating type of room, the abrasive which accumulates in the hopper below the room is conveyed by a worm conveyor into the boot of a bucket elevator, located outside of the sandblast room. The bucket elevator discharges the abrasive over two screens into the sandblasting machine. The exhaust system connected to the abrasive storage separates the fine dust from the abrasive when the latter falls through the screens.

While size and numerous details of design of this type of room vary greatly to meet the particular needs for which the installation is made, the important features remain practically the same. The room is constructed of heavy steel plate with dust proof seams. It is lighted by electric lights which have heavy wired glass to protect the bulbs. The floor grating, which is made in sections, is constructed of 2-inch bars set on edge.

In practically all rooms built by this manufacturer, the side draft, partitioned method of ventilation is featured. In this type of construction—which is illustrated in Fig. 60, the operator is separated from the work by a partition built across the room. This partition has an opening of suitable size through which the operator directs the stream of abrasives. Fresh air enters the room through ventilators located in the roof of the operators' side of the room. Air then passes down around the operator, through the opening in the partition, around the work and out through the exhaust on the side of the room opposite the operator. In some rooms of this type, the dust arrester is mounted on top of the sandblast room, as shown in Figs. 60 and 61.

Uses Rotary Table

This type of sandblast room also may be equipped with a rotary table, shown in Fig. 61, upon which the work is carried into and out of the blast room. This table is fastened to a heavy shaft held in place by a dust proof socket bearing and top bearing. One of the table arms is equipped with a sand brush or scraper which removes the abrasive that may fall through the grating into the sand pan outside of the room. The same company also builds a rotary table room without a pit. In this room the used abrasive falls into a hopper directly under the table and is carried to the storage bin pneumatically. A room of this type is shown in Fig. 61.

Down draft ventilation and the mechanical, gravity and pneumatic methods of handling the abrasive are featured by another manufacturer specializing in sandblast equipment. In ventilating this room, air is drawn in at the top through circular air vents protected by cone-shaped guards. The guard prevents pieces of abrasive from flying out of the room through the circular ventilating holes. The air then passes down around the operator and further down around the work, carrying the dust toward the sides of the room, where the exhaust ducts are located near the floor. The dust laden air entering the ducts is carried to the dust arrester. In rooms equipped with any of the three types of equipment for handling the abrasive, the ventilating air does not pass through the gratings in the floor.

In rooms equipped with the mechanical method of handling the abrasive, the sand falls through perforated plates into a hopper below the room. The perforated floor plates act as a screen and prevent wires, gaggers, etc., from falling into the hopper and eventually causing trouble with the equipment. The spiral conveyor, which passes under the hopper, carries the abrasive to an elevator boot and a bucket elevator carries it to the separator, where the abrasive is reclaimed.

This separator provides both air and mechanical separation of the abrasive and the dust. The abrasive first is thrown against baffle plates by the bucket elevator. The abrasive

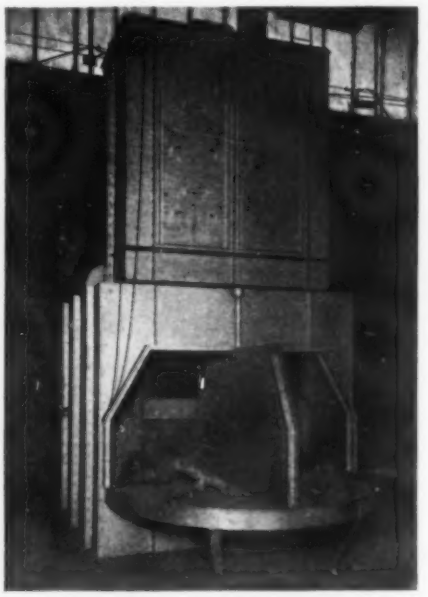


FIG. 61—THE DUST ARRESTER UNIT MAY BE REMOUNTED ON TOP

is spread into a wide, thin stream and dropped into the exhaust air current. Fine dust particles are carried away by the air to the dust arrester and usable material drops to the mechanical separator, which consists of a double screen of the proper mesh, when sand is used, and a solid plate for steel abrasives. The screen or plate is vibrated by two contact rollers, the upper roller or idler carrying the screen frame. The lower roller is ribbed on its contact face so that the rotation lifts and drops the idler roller and screen. The screen is supported at the proper angle to be self cleaning when vibrated.

In the gravity type handling system, a screen on the floor hopper catches the gaggers, nails and other refuse. The sand then passes through a separator similar to that just described, and then into the sandblast machine. The gravity system may be installed without the separator where conditions are such that it is

not needed. The construction of the floor in the pneumatic system of handling the abrasive is the same as employed with the mechanical system. Abrasive falls into a hopper where an elevating pipe, operating pneumatically, elevates it to the separator located immediately above the sandblast machine.

The abrasive material is separated by discharging it into an expansion chamber having an adjustable baffle. The air velocity, which may be regulated to accommodate the particular type of abrasive used, causes the fine, useless particles to be separated from the heavier and reusable abrasive. The former is carried by the blast of air to the dust arrester while the latter is returned to the sandblast machine. Any large material, which may have been carried to the separator, is retained on the refuse screen.

That company also builds a semi-manual type room, which differs from the rooms which have been described in the method of handling the abrasive. This room is built with a solid floor with all of the mechanism above the floor line. As often as the occasion demands, the operator sweeps or shovels the abrasive material into a chute which is built in the wall about 2 feet above the floor level, or, if conditions permit, in the floor. A bucket elevator then carries the abrasive to the sand separator.

The room is constructed of steel plate built on a steel angle frame, which is braced to secure rigidity. The base angles of the steel frame are bolted to the room foundation. Heavy beams support the floor gratings, the beams being larger where the load necessitates. Electric lighting fixtures diffuse the light evenly throughout the room. The bulbs are enclosed in heavy glass globes held in cast iron fixtures bolted to the ceiling. The floor is made up of perforated steel plates bolted to the supporting beams. These rooms may be equipped with turntables if desired.

Another leading sandblast equipment manufacturer builds rooms having either the pneumatic or the mechanical methods of handling the abrasive. The rooms are constructed of steel plates and perforated plates or gratings supported by floor beams. The down draft system of ventilation is used with a double ventilating roof so constructed of angles that the free access of air is permitted while the escape of rebounding abrasive is prevented. The method of ventilating and the construction of the slots are shown in Fig. 53. Ventilating ducts for removal of the dust laden air are located near the floor as illustrated in Fig. 59. The room is lighted with electric lights, properly protected and placed along the sides of the room near the ceiling, as may be noted in Fig. 53, or suspended from the ceiling.

In the pneumatic type abrasive handling machine, a feed hopper is attached to the bottom of the large floor hopper. The feed hopper is equipped with inclined perforated plates which discharge the coarse refuse but permit the abrasive and dust to feed into the elevating pipe. An adjustable gate controls the rate of flow of the abrasive into the pneumatic carrier. The abrasive then passes through a pneumatic separator, where the fine dust is removed by a blast of air and the abrasive is returned to the pressure tank.

This type of room may be equipped with a rotary table. A double room also is built, with one sliding door and one ventilating unit. While the operator sandblasts in one room the other is being loaded. Sliding the door automatically shuts off the elevating, separating and ventilating equipment in one room and connects it with the other room.

Another type of equipment now on the market may be built with either the down draft or the up draft method of ventilation. With the updraft method, the air inlet slots are located at the bottom of the side walls and the exhaust hood is near the roof. This type has the mechanical method of handling the abrasive.

Practically all types of sandblast rooms may be equipped with a monorail system to handle the castings in and out of the room, with a car track and car, with the turntable or with a combination of two or all methods.

This is the sixth of a series of articles dealing with cleaning room equipment. The seventh, which will continue with the subject of sandblast equipment, will appear in an early issue.

Bill Touches Upon Some Molding Problems

(*Concluded from Page* 399)

shown at *C* is the simpler of the two and is preferable from an all around utility viewpoint.

"On long, deep jobs where the sand forming the side walls must be reinforced to prevent them from sagging or slipping, chuck bars similar to that shown in *D* will serve the purpose and also dispense with a lifting plate on the bottom. However, unless these chuck bars are spaced closely the sand between will have to be gaggered, or wood soldiers will have to be employed to hold the sand during the period the cheek is removed from the drag for finishing and if necessary for drying purposes.

"In some instances a crab or crabs made in open sand molds is or are employed in place of the lifting plates. They are almost as convenient as the plates and they can be made without a pattern. This consideration has some weight in a foundry operated independently of a pattern shop."

Book Review

Cast Iron in the Light of Recent Research, by William H. Hatfield, 340 pages, cloth 6 x 8½ inches, published by Charles Griffin & Co. Ltd., London, and supplied by THE FOUNDRY, Cleveland, for $9.00, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster, for 16s.

This is the third edition of this notable work on cast iron, and has been brought up to date. The first chapter deals with iron-carbon alloys and cast iron from the standpoint of the equilibrium diagram. This is followed by chapters on the influences of silicon, phosphorus, sulphur, manganese and other elements. Chapter VII deals with the physical properties of cast iron and chapter VIII with the influence of casting temperature. Shrinkage and contraction in cast iron, annealing, and growth of cast irons after heating are discussed in chapters IX, X and XI. Chapter XII describes the effect of working temperatures on parts of internal combustion engines and chapter XIII with the effect of superheated steam. Then follow chapters on malleable cast iron, heat treatment, and permissible phosphorus content in malleable castings. Chapter XVII deals with the influence of sulphur on the stability of iron carbide in the presence of silicon; chapter XVIII with chemical physics of decarburization of cast iron without further fusion; chapter XIX with the mechanical properties of cast and malleable cast iron, and chapter XX with furnaces and slags. The final chapter describes X-ray examination of materials. An appendix of 19 pages includes nomenclature and the composition of pig iron.

The United States Electrical Tool Co., Cincinnati, recently opened a branch office at 205 University building, Syracuse, N. Y., in charge of H. N. Kelsey. Sales in the entire state of New York with the exception of a part adjacent to New York city, will be directed by the Syracuse branch office. Mr. Kelsey previously was connected with the Syracuse Twist Drill Co., Syracuse, N. Y., the Waltham Grinding Wheel Co., Waltham, Mass., and the Ross Mfg. Co., Cleveland.

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor

CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ More Cast Iron Pipe

RECENT statistical information issued by the American Iron and Steel institute shows a steady increase in the production of cast iron pipe of all kinds between the years 1922 and 1927, inclusive. The production is given in net tons and the pipe is classified under two headings: (a) gas, water and culvert, (b) soil pipe and fittings. Tonnage for the first classification for successive years shows 926,577 for 1922; 1,134,959 for 1923; 1,365,272 for 1924; 1,414,252 for 1925; 1,534,278 for 1926; and 1,488,644 for 1927. Tonnage for the second classification is tabulated in the same manner as: 356,872; 432,828; 476,078; 510,483; 469,228; 553,871. The totals have risen from 1,283,449 tons in 1922 to 2,042,515 tons in 1927, an increase of practically 60 per cent. These figures do not include varying small tonnages of foreign pipe imported at intermittent periods during these years. From a foundry viewpoint the value of the report would have been enhanced greatly had it presented figures showing the relative tonnage produced by the ordinary methods and by the centrifugal process.

¶ Scan the Records

AT PRESENT much is heard about research, and the benefits that may be derived from the scientific investigation of technical problems. Some times, the impression is left that little is being done along this line that will benefit the foundry industry, when in truth only a few really know what is being done. One of the best measures of the work that has been done and that now is in the process of investigation, will be found in the papers that are presented at the meetings of various national associations directly in line or tangent to the foundry industry.

IT IS gratifying to note the large number of papers that have been prepared for discussion at the meetings of various groups this spring. A report from the American Society for Testing Materials shows that 56 papers have been offered for presentation at its annual convention, to be held in June. About 45 papers were prepared for the annual convention of the American Foundrymen's association at Philadelphia. While not all of these papers deal with research, the majority of them touch upon features of investigation.

THE excellent showing by these two organizations demonstrates that there is no dearth of research and investigation. Further when it is considered that there are numerous other organizations both in America and Europe following the same trend, it easily may be seen that research within the foundry industry is being reared on a firm foundation. The main thing to guard against is duplication of effort. Hence, the periodicals and transactions of the various societies should be consulted carefully before engaging in any new line of study or intensive research.

¶ Review Steel Castings

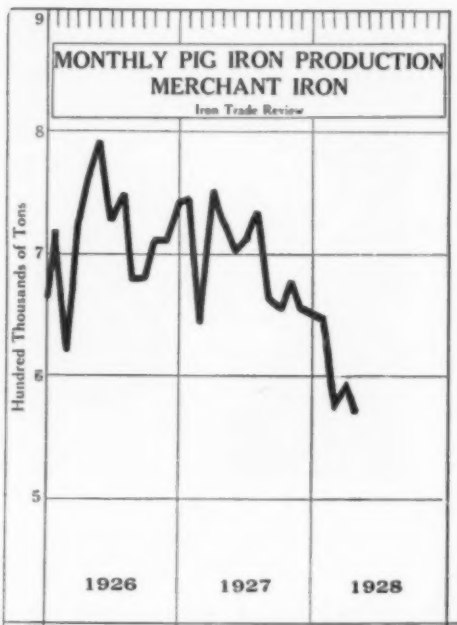
ACCORDING to figures issued recently by the American Iron and Steel institute, 301 works in 34 states, the District of Columbia, Alaska and the Canal Zone, Panama, were engaged in the production of steel castings in 1927 as compared with 293 works in the same districts operating in 1926. However, although the total number of plants was greater the total tonnage produced was smaller by 199,150 tons. This decrease applies in approximately equal proportionate measure to the volume of castings made by each of the recognized methods, open hearth, basic and acid, bessemer, crucible and electric. The open hearth still is the main tonnage producer with a total of 824,295 tons in 1927 as against 986,996 tons in 1926 almost equally divided between acid and basic. This is approximately three times that of its nearest competitor, the electric furnace credited with a production of 294,809 tons in 1927 and 326,445 tons in 1926. Steel castings made in bessemer shops in 1927 amounted to 38,024 tons, 5042 tons less than the production of 1926. Figures for the crucible casting branch show a loss of 701 tons between the 2041 tons produced in 1926 and the 1340 tons made in 1927. Production of electric steel castings shows a loss of 31,636 tons between 1927 and 1926.

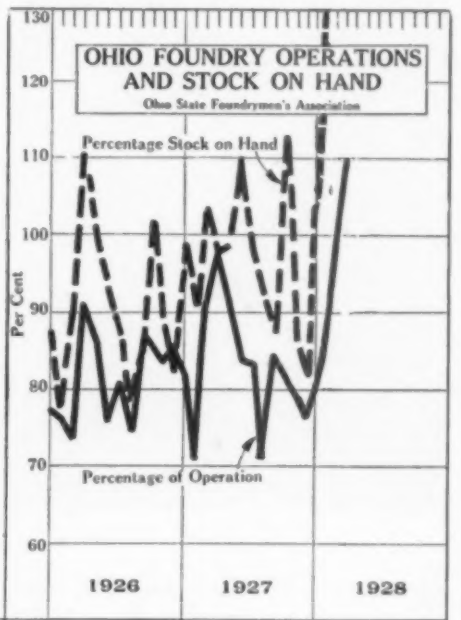
Trade Trends in Tabloid

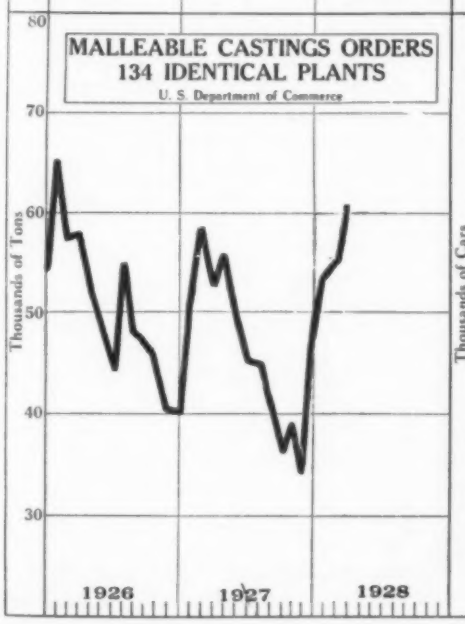
FOUNDRY operations are holding to a fairly high level during the late spring. Jobbing interests in the eastern states and in the Mississippi valley report no slackening of orders, although hand-to-mouth buying still governs. Demand for malleable castings is fairly constant, with an increase each month since the first of the year. The iron and steel industry has maintained its stride through April. The total production of pig iron, according to statistics compiled by *Iron Trade Review*, increased approximately 2800 tons per day during April, showing a gain of 2.7 per per cent. The total of merchant iron produced in April was 573,630 tons, compared with 597,106 for March. Two merchant stacks were blown out and none lighted during the past month. Freight car loadings have slackened slightly in the latter part of April and early May. Similarly, car orders were not as plentiful as had been hoped, for the close of the spring season. Automobile production has been spotty. One or two makers with changes in models have maintained high schedules, but some have slowed down. Building contracts continue to maintain a high level. Average monthly prices during April on nonferrous metals according to New York quotations in the *Daily Metal Trade* follow: Casting Copper, 13.898c; electrolytic copper, 14.238c; Straits tin, 52.323c; lead, 6.10c; antimony, 9.891c; aluminum, 23.90c.

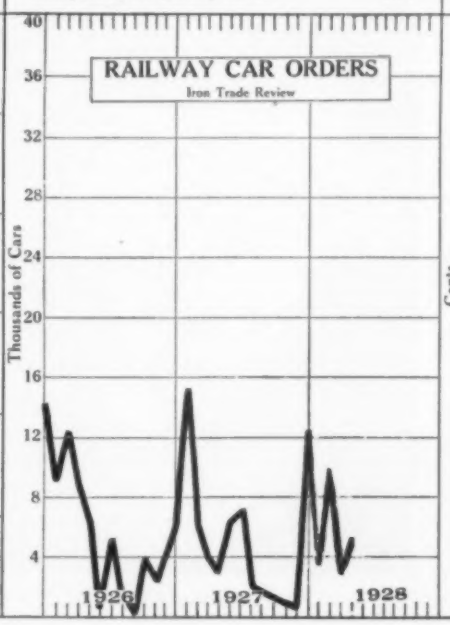
RAW MATERIAL PRICES
May 8, 1928

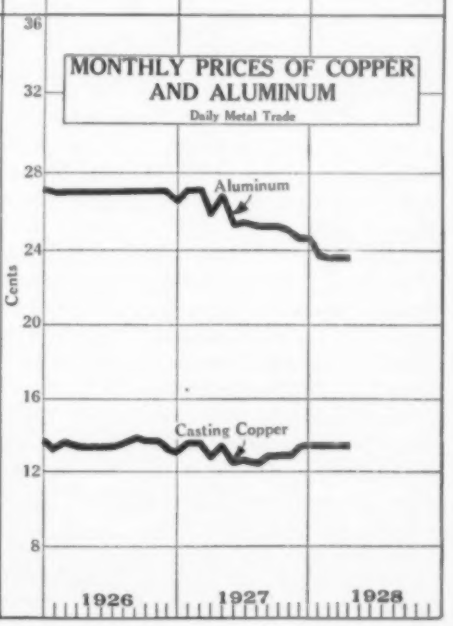
Iron	
No. 2 foundry, Valley	$17.25
No. 2 southern, Birmingham	16.00
No. 2 foundry, Chicago	18.50
No. 2 foundry, Philadelphia	20.76
No. 2 foundry, Buffalo	17.00
Basic, Valley	16.25 to 16.50
Basic, Buffalo	17.00
Malleable, Chicago	18.50
Malleable, Buffalo	17.50
Coke	
Connellsville foundry coke	$3.60 to 4.25
Wise county foundry coke	4.00 to 5.00
Scrap	
Heavy melting steel, Valley	$14.25 to 14.75
Heavy melting steel, Pitts	15.00 to 15.75
Heavy melting steel, Chicago	13.00 to 13.50
Stove plate, Buffalo	12.75 to 13.25
Stove plate, Chicago	11.50 to 12.00
No. 1 cast, New York	13.00 to 13.50
No. 1 cast, Chicago	14.25 to 14.75
No. 1 cast, Philadelphia	16.00 to 16.50
No. 1 cast, Pittsburgh	14.50 to 15.00
No. 1 cast, Birmingham	14.00 to 14.50
Car wheels, iron, Pittsburgh	14.50 to 15.00
Car wheels, iron, Chicago	13.50 to 14.00
Railroad malleable, Chicago	12.75 to 13.00
Agricultural Mal., Chicago	11.75 to 12.25
Malleable, Buffalo	15.00 to 15.50
Railroad malleable, Pitts	15.00 to 15.50
Nonferrous Metals	
	Cents per pound
Casting copper, refinery	14.00
Electro copper, producers	14.25
Straits tin	51.25
Lead, New York	6.10
Antimony, New York	11.00
Nickel, electro	37.00
Aluminum, No. 12, producers	23.00
Aluminum, No. 12, remelt	16.50 to 17.00
Zinc, East St. Louis, Ill.	6.00











Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

W. W. CHENEY JR., recently elected president of the Central New York State Foundrymen's association, is vice president in charge of production of S. Cheney & Son, Manlius, N. Y. Mr. Cheney received his technical education at the Sheffield Scientific school of Yale university, New Haven, Conn., and then became connected with the former Corrigan, McKinney Iron Co., as chemist in mine operations. Later he was blast furnace chemist for the

W. W. CHENEY JR.

Illinois Steel Co. He has been connected with S. Cheney & Son for the past 16 years. Mr. Cheney is a former president of the Syracuse Foundrymen's association and a director of the Syracuse Manufacturers' association, a member of the National Founders association, the American Foundrymen's association and the American Chemical society.

Otis Morgan has been placed in charge of the annealing department of the Herschel Mfg. Co., Peoria, Ill.

P. L. Livingston has been made foundry superintendent of the Bessemer Gas Engine Co., Grove City, Pa.

J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., will address the members of the Quad-City Foundrymen's association at a dinner meeting May 21.

Jack Davis has been made foundry superintendent of the M. Hoagland's Sons Co., Rockaway, N. J. Mr. Davis formerly was foundry foreman of R. Hoe & Co., Dunellen, N. J.

William H. McIntyre has been made sales manager for the Dempsey Foundry Co., Sharon, Pa. Mr. McIntyre started his foundry work with the American Steel Castings Co., spent 13 years in charge of sales for the Sharon Foundry Co., Sharon, and later was chosen president of the Salisbury Iron Corp., Lime Rock, Conn.

Charles M. Kepner, for the past 11 years foundry superintendent of the Kokomo Brass Works, Kokomo, Ind., has been made foundry superintendent of the Bunting Brass & Bronze Co., Toledo, O.

Wm. E. Walker, recently elected secretary and treasurer of the Central New York Foundrymen's association, is foundry manager of E. C. Stearns & Co., Inc., Syracuse, N. Y. Mr. Walker was graduated from Colgate university, Hamilton, N. Y., in 1914 and immediately entered the employment of the Perkins Foundry Co., Amsterdam, N. Y., which was established by his grandfather in 1834. During the war Mr. Walker was connected in a civilian capacity with the bureau of aircraft production and was stationed at the Wright-Martin Aircraft Corp., New Brunswick, N. J., as auditor of foundry costs. Wright & Martin were producing Hispano Suiza motors on a cost plus contract and their aluminum foundry at that time

W. E. WALKER

was the largest in the country. After the war he spent two years as assistant comptroller of the H. H. Franklin Mfg. Co., Syracuse, and then became connected with the Lamson Co., Syracuse, where he had charge of the foundry department. Later he accepted his present position as foundry manager of the E. C. Stearns & Co. Inc.

Charles D. Steinmeier has been appointed sales representative of the

C. D. STEINMEIER

American Foundry Equipment Co. Inc., Mishawaka, Ind., with headquarters at Philadelphia. Mr. Steinmeier became connected with the American Foundry Equipment Co. in 1919, having previously been foundry superintendent of Nordyke & Marmon Mfg. Co. of Indianapolis. He was manager of the York, Pa., plant of the American Foundry Equipment Co. until the consolidation of all plants at Mishawaka, Ind., when he was made assistant works manager.

A. V. DeForest, research engineer, American Chain Co. Inc., Bridgeport, Conn., has been awarded the Charles B. Dudley medal by the American Society for Testing Materials for his paper on "A Method of Graphic Representation of Magnetic Characteristics", which was presented at the annual meeting of the society last year. Mr. DeForest was graduated from the Massachusetts Institute of Technology, Cambridge, Mass., in naval

architecture in 1912. He was with the New London Ship & Engine Co., for a year after which he became an instructor in civil engineering at Princeton university, Princeton, N. J. Later he studied metallography at Princeton and at Columbia university, New York. Mr. DeForest then spent two years in the research department of the Remington Arms Union Metallic Cartridge Co., and in 1918 he assumed his present post as research engineer with the American Chain Co.

Hugo Wolff, recently elected secretary-treasurer of the Quad-City Foundrymen's association, is production manager, Frank Foundries Corp., Davenport, Ia. From 1911 to 1917 Mr. Wolff was engaged in estimating

HUGO WOLFF

general and builders hardware lines. In 1918 he became connected with the Rock Island arsenal, where he worked in the planning room and the production department of the artillery vehicle section. In 1924 he accepted a position with the Frank Foundries Corp., at the Davenport plant, in the capacity of production manager.

W. E. Adams has been appointed superintendent of the Burnside Steel Foundry Co., Chicago, succeeding L. M. Bassini, who recently resigned.

E. E. Arnold has been appointed mechanical engineer for special assignment for the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. About 20 years ago Mr. Arnold was connected with the Westinghouse company and since that time has been with the Metal Products Co., Detroit, A. O. Smith Co., Milwaukee and the New Departure Mfg. Co., Bristol, Conn.

Talks on Sand

Walter M. Saunders, Saunders & Franklin, Providence, R. I., addressed the members of the Philadelphia Foundrymen's association at a meeting held at the Manufacturers' club, Philadelphia, May 9, on the subject of foundry sands. Mr. Saunders is a member of the joint committee of molding sand research of the American Foundrymen's association. B. H. Johnson, Cresson-Morris Co., Philadelphia, presented some information on the newly organized Gray Iron Institute.

Sells Sand Machines

The Royer Foundry & Machine Co., Wilkes-Barre, Pa., has sold sand separators and blenders to the Josiah Anstice Co., Inc., Rochester, N. Y.; Apex Bronze & Brass Works, Oakland, Calif.; Atlas Foundry & Machine Co., Tacoma, Wash.; Canadian Westinghouse Co., Ltd., Hamilton, Ont.; Crane Co., Chicago; Ferro Bronze Studios, Inc., Dayton, O.; Lattimer-Stevens Co., Columbus, O.; Monroe Auto Equipment & Mfg. Co., Monroe, Mich.; Reading Steel Casting Co., Hartford, Conn.; Tennent Steel Corp., Tacoma, Wash.

Speaks on Improvements

E. A. Custer Jr., Philadelphia, addressed the regular monthly meeting of the New England Foundrymen's association held at the Exchange club, Boston, Wednesday, May 9. Mr. Custer spoke on recent improvements in gray iron foundries and their significance to foundrymen. H. S. Chafee, Builders Iron Foundry, Providence, R. I., presented information on the Gray Iron institute.

Directors Are Elected

Robert W. Baird has been elected a director of the Chain Belt Co., Milwaukee, to fill the vacancy caused by the death of H. O. Seymour. Mr. Baird is vice president of the First National Bank, president of the First Wisconsin Co. and vice president of the First Wisconsin Trust Co. The following directors were re-elected by the board of the Chain Belt Co.: Donald Fraser, William C. Frye, J. C. Merwin, C. R. Messinger, Clifford F. Messinger and Edgar L. Wood.

Officers Are Elected

At a recent meeting of the Quad-City Foundrymen's association, the following officers were elected: President, A. D. Matheson, French & Hecht, Davenport, Ia.; vice president, F. W. Kirby, John Deere Spreader Works, East Moline, Ill.; secretary & treasurer, Hugo Wolff, Frank Foundries Corp., Davenport, Ia.

Made District Manager

Andrew S. Coulter has been appointed district manager in the Chicago office of the Werner G. Smith Co., Cleveland. Mr. Coulter formerly was associated with the James H. Herron Co., Cleveland, consulting engineers. He also has been research engineer for the Westinghouse Airbrake Co., Swissvale, Pa., and metallurgist for The Crown Cork & Seal Co., Baltimore. He is a member of the American Institute of Mining and Metallurgical Engineers, American Foundry-

A. S. COULTER

men's association and American Society for Steel Treating. He received his technical education at the University of Pittsburgh, Pittsburgh.

Appoints Representatives

Royer Foundry & Machine Co., Wilkes-Barre, Pa., recently has appointed two new representatives. The Western Foundry Sand Co., Seattle, will represent the Royer company in Washington, Oregon and British Columbia. W. R. Tompkins is manager of the Western Foundry Sand Co. The Canadian Foundry Supplies & Equipment, Ltd., Montreal, Que., will represent the Royer company in Newfoundland and all Canada with the exception of British Columbia.

The Mayer Fuel Saving Furnace & Equipment Co., Cleveland, has sold three car type ovens to the Detroit Gray Iron Foundry Co., Detroit.

Glue Pot Is Portable

Black & Decker Co., Towson, Md., recently has introduced a small electric glue pot. This unit is light and is designed to be carried to the job,

THE ALUMINUM CONTAINER HOLDS TWO QUARTS OF GLUE

instead of taking the work to the glue pot. The glue is maintained at constant temperature of 150 degrees Fahr. by a heating element which consists of a special metal ribbon with mica plates and a thermostatic control. The container, of 2-quart capacity, is cast aluminum, carefully machined to fit a gray iron receptacle.

The heating element is sealed tightly with asbestos to eliminate fire hazard, short circuits, etc. The sides of the pot are sloped to minimize spillage and a heavy iron wiper across the center of the glue container prevents waste from drippage.

Applies Cement Surfaces with Compressed Air

The S. Obermayer Co., 2563 W. 18th street, Chicago, recently has introduced a new cement gun for use in maintaining furnace linings, boiler settings and similar refractory surfaces. Each gun is fed by a 20 gallon tank equipped with an adjustable reducing valve to provide for variations in the air pressure used. One short nozzle, which may be used in places easily reached, and one long nozzle, for more difficult locations, also are standard equipment. Air and cement reach the nozzles through two 25 foot lengths of hose attached to the storage tank and both air and cement are regulated at the gun head by valves. The density of the spray may be controlled easily by varying the amount of air and material admitted.

The machine may be cleaned easily by closing the cement valve and allowing the air to clean the nozzle. The cement remaining in the hose may be forced back into the tank by releasing the pressure on the tank through the bleeder valve and by passing the air into the cement hose by placing a finger over the nozzle. The cement valve on the gun is opened for that operation. When the hose has been cleared, the valve at the cement outlet on the tank may be closed to retain the cement in the storage chamber.

Ingredients are mixed in the tank by air. The air line is connected to the cement outlet, the bleeder valve is opened and the air admitted through the valve at the base of the tank. As the air rushes through it sets up a swirling movement before it escapes at the top. This mixes the material. The gun operates on pressure as low as 30 pounds. Each length of hose has special clamps on couplings which may be adjusted quickly and which afford tight connections.

Buys Hoist Division

The Columbus McKinnon Chain Co., Tonawanda, N. Y., has purchased the chain block, electric hoist and crane

INGREDIENTS ARE MIXED IN THE TANK

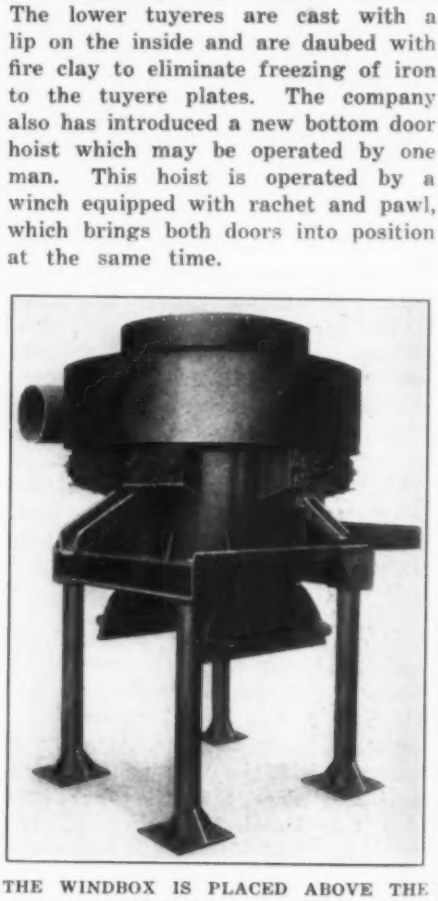
division of the Chisholm & Moore Mfg. Co., Cleveland. The sales office of the plant will remain at Cleveland and will be operated as the Chisholm-Moore Hoist Co., a division of the Columbus McKinnon Chain Co. Sam H. Moore, president and founder of the Chisholm & Moore Mfg. Co., will continue with the organization and the personnel of the company will remain unchanged. A new corporation has been organized to take over the foundry division of the Chisholm-Moore plant and will be known as the Chisholm-Moore Malleable Iron Co.

Changes Cupola Design

The Whiting Corp., Harvey, Ill., has introduced a new structural type cupola, which has bottom doors fabricated from heavy boiler plate. The cupola has straight cylindrical columns of wrought steel, which are filled with concrete when installed. A new safety spout has been built at the bottom of the tuyere elbow. A fusible lead plate of larger size than that used in previous models of the cupola is clamped tightly in a vertical position. The safety channel is merely a depression in one tuyere, two inches deep, leading to the safety spout.

All joints of the windbox are welded. The windbox is placed above the tuyere boxes or elbows to eliminate the possibility of iron and slag flowing into the wind chamber. Each tuyere elbow has a large peephole and a hand hole and the bottom may be detached easily for cleaning. The tuyeres are of a special continuous type and are adjustable to suit any particular condition.

The slag spout is a heavy, cast-iron section, 11½ inches wide which prevents the slag from freezing up near the shell and running over the side. The size of the lower tuyeres is regulated by opening in the shell. This area may be reduced by moving in the supporting plates shutting off the shell opening any desired amount. The lower tuyeres are cast with a lip on the inside and are daubed with fire clay to eliminate freezing of iron to the tuyere plates. The company also has introduced a new bottom door hoist which may be operated by one man. This hoist is operated by a winch equipped with rachet and pawl, which brings both doors into position at the same time.



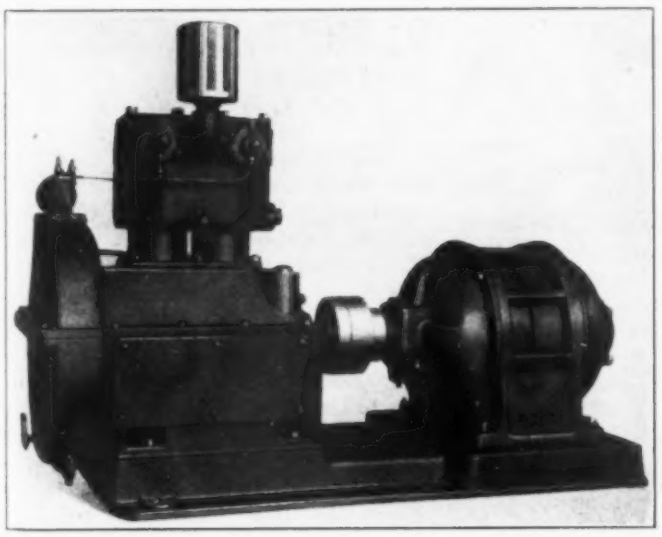
THE WINDBOX IS PLACED ABOVE THE TUYERE BOXES

Vertical Air Compressor Is Compact

The Sullivan Machinery Co., 122 South Michigan avenue, Chicago, has introduced a vertical, direct-motor-driven, air compressor designed for shop and miscellaneous industrial requirements in which a relatively small amount of compressed air is needed and in which compactness, small floor space occupied, continuous operation, portability and practically automatic control are important factors.

The two compressor cylinders are cast in one block and bolted to the crankcase. A one-piece cylinder head is bolted to the top of the block. A special type valve, which is the standard equipment on all compressors made by the Sullivan company, is used for both inlet and discharge. An air filter is attached to the intake opening, which removes dust and solid matter from the air. The crankcase is a massive casting, supported on the base on planed shoulders which extend the full length of the compressor. It carries two bearings with strongly bolted caps for supporting the crank shaft, and has large oil channels to carry oil to the bearings. Large hand plates are bolted to the sides of the base to permit access to the bearings.

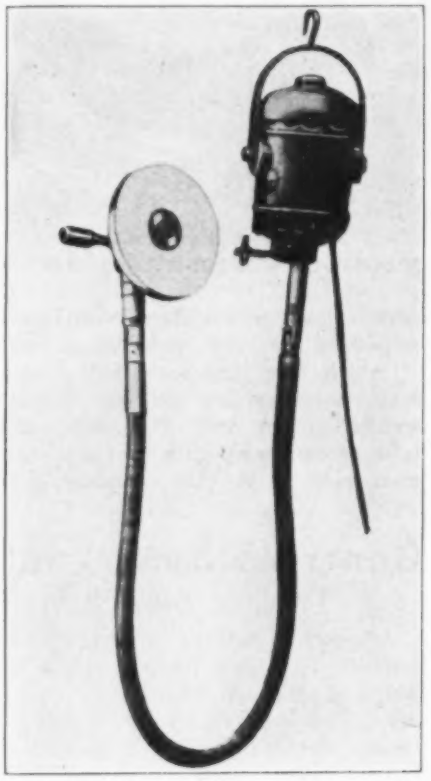
The compressor and motor shafts are connected by a special flexible coupling, consisting of a pinion on the end of the compressor shaft which meshes around its entire circumference with an internal gear, attached to the motor shaft. The pistons are the hollow or automobile type and are made of a special grade of iron carefully annealed. The cylinders of the compressor are cooled by water jackets. To maintain a constant air pressure, these compressors are provided with an unloading appliance, which automatically interrupts the compression of air when the required pressure is reached. This appliance maintains the air pressure within five pounds of the desired amount, by raising the inlet valves from their seats so that the air entering the cylinder on the suction stroke is swept through it and expelled through the open inlet valves on the return stroke.



THE COMPRESSOR IS DRIVEN BY A DIRECT-CONNECTED MOTOR

Designs Flexible Shaft

The Stow Mfg. Co. Inc., Binghamton, N. Y. recently has introduced a direct connected, suspended, flexible shaft unit for such operations as grinding, polishing, sanding and finishing. Power is supplied by a ball bearing motor of one horsepower capacity. As may be noted in the accompanying illustration the motor may be suspended from any convenient support by a hook. The power is carried to the attachment in use through a flexible shaft. The standard length of this shaft is 6 feet although all lengths may be secured. The flexible shaft may be attached to the angle head, as shown in the accompanying illustration, or a rotary motion may be given to the attachment direct from the end of the flexible shaf. The equipment is designed to permit quick interchange of attachments.



THE FLEXIBLE SHAFT IS DIRECT CONNECTED TO THE MOTOR

THE UNIT HAS A CAPACITY OF 1000 CUBIC FEET OF AIR PER MINUTE

Blanket of Cellulose Filters Air

The National Air Filter Co., Chicago, recently has developed a new type of filter for cleaning air used in cooling large motors, compressed air, etc. In this filter a blanket of cellulose material is utilized as a dirt collecting medium. Each ply of the blanket consists of a thin mat of fine cellulose fibers, which are sufficiently open to permit easy flow of air. It is claimed that when several plies of the celluose material are placed together in a blanket, the air must pass through a large number of small passages into which the ends of the fibers project from all sides. These projections catch the small particles of dust and allow the clean air to pass through.

A single unit consists of a sheet metal box 12 x 24 x 24 inches with a filtering capacity of 1000 cubic feet of air per minute. These units may be used singly or placed in multiples. The filtering material is carried between two frames of coarse wire screen hinged together on one side. These frames are of the proper size to receive a single blanket 24 inches square. Each unit contains four frames which form a set of staggered partitions giving 16 square feet of filter surface for each unit. A simple spring clip holds the frames in position.

FIG. 1—A GOVERNOR REGULATES THE MOTOR SPEED

Pneumatic Tools Have Special Motors

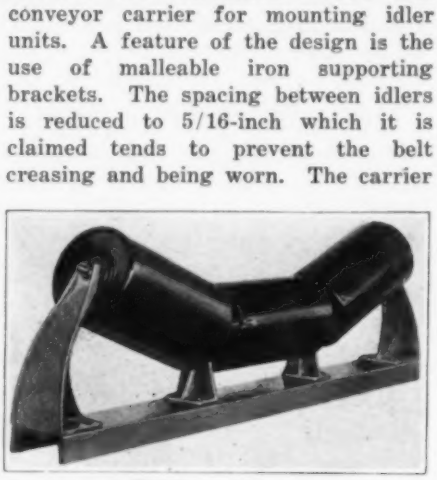
The Independent Pneumatic Tool Co., 600 West Jackson boulevard Chicago, recently has introduced a new line of rotary air grinders and sanders. It is claimed that this equipment is balanced perfectly, and is equipped with a vibrationless motor, a governor, a lubricator and a muffler. The motor, which carries four bakelite blades, is extremely light and is mounted on a rigid shaft supported by ball bearings. The spindle also is suspended and held in alignment by ball bearings at each end.

The governor is enclosed fully and also is adjustable. The governor keeps the speed and air consumption at a low point when the machine is running idle. When the wheel is applied to the work, the governor automatically throttles the machine to the speed required for the job. The automatic oiler carries sufficient light oil to lubricate all moving parts for eight hours. The baffle plate muffler, which is incorporated in a box-like lug on the spindle support, makes a quiet, comfortable motor to handle. The smaller grinder weighs 15½ pounds, has a speed of 4000 revolutions per minute and an air consumption at no load of 20 cubic feet at 90 pounds. It carries a 6-inch emery wheel with 1½-inch face. The larger grinder, which is shown in the illustration, weighs 17¼ pounds and has a speed of 3200 revolutions per minute. Air consumption is the same as for the smaller tool. The larger grinder carries an 8-inch emery wheel with 1½-inch face. The sander also shown in the illustration, has a right angle housing. It operates at a speed of 4000 revolutions per minute with the same air consumption as the grinder. It carries any size disk up to 9 inches in diameter.

FIG. 2—THE SANDER HAS A RIGHT ANGLE HOUSING

Use Malleable Brackets

The Stearns Conveyor Co., Cleveland, recently has introduced a new belt conveyor carrier for mounting idler units. A feature of the design is the use of malleable iron supporting brackets. The spacing between idlers is reduced to 5/16-inch which it is claimed tends to prevent the belt creasing and being worn. The carrier



SPACING BETWEEN IDLERS IS REDUCED

may be used with either pressed steel or chilled rim cast iron idlers, both of which have one piece pulley steel construction, roller bearings and a special grease seal. The new idler is interchangeable with previous units manufactured by that company.

Controls Sander with Trigger Switch

A new electrically driven sander recently has been introduced by the Black & Decker Mfg. Co., Towson, Md. The sand pad is driven by an electric motor through a train of heat treated, steel gears which run in a

THE SAND PAD IS DRIVEN BY A MOTOR THROUGH STEEL GEARS

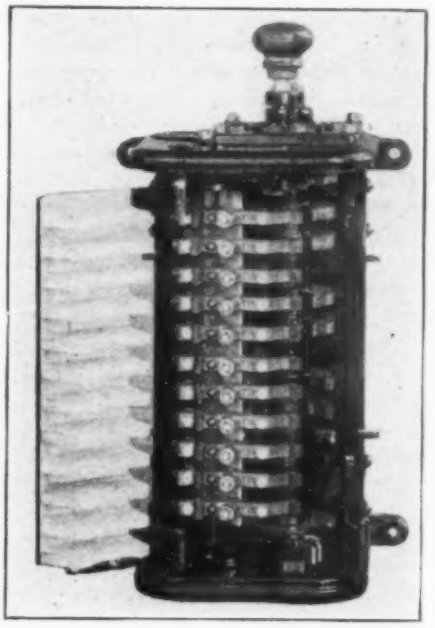
grease-tight compartment. The motor and all revolving shafts are mounted on ball bearings. The operator controls the machine with a pistol grip and trigger switch as may be noted in the accompanying illustration. This equipment may be secured for any desired voltage.

Builds Drum Switch

Three new drum switches for use with squirrel-cage and slip-ring motors recently have been placed on the market by the General Electric Co., Schenectady, N. Y. These switches have been designed particularly for the control of small cranes, hoists, machine tools, etc., but they may be applied to any work where a small and inexpensive drum switch is desired for a squirrel-cage or slip-ring motor.

One type is a primary resistance drum switch for squirrel-cage motors, providing four points forward and four points reverse. It is suitable for motors that do not have an overhauling load. For example, on hoists this switch may be used where worm gearing or automatic mechanical load brakes are used.

The second type is a primary resistance switch for squirrel-cage



THE SWITCHES ARE DESIGNED FOR SQUIRREL CAGE AND SLIP RING MOTORS

motors, providing four points forward and one point reverse. This switch is suitable for use where there is an overhauling load. For example, on hoists this switch should be applied where a worm gear or automatic mechanical load brake is not used. In such cases one point reverse is provided so that the motor will exert sufficient torque to prevent excessive motor speeds when overhauled by the load.

The third type is a primary and secondary reversing switch for slip-ring motors, providing five points forward and five points reverse. It is suitable for starting duty or speed regulating duty, and with 220, 440 and 550-volt motors, rated 15 horsepower or less, where a five-point switch should be chosen.

Swing Grinder Operates at High Speeds

The Norton Co., Worcester, Mass., recently has developed a new swing frame grinding machine designed especially to meet the requirements of high speed snagging service. Although this machine weighs only about 850 pounds, its construction is exceedingly rugged. The hood complies with safety code requirements for wheels which are operated at 9000 surface feet per minute. Wheels 24 inches in diameter, from 2 to 3 inches thick and with either 8 or 12 inch holes may be used. Two speed changes are possible through the duplex sheave on the motor. Either 24 or 20-inch diameter wheels may be operated at 9000 surface feet per minute. The

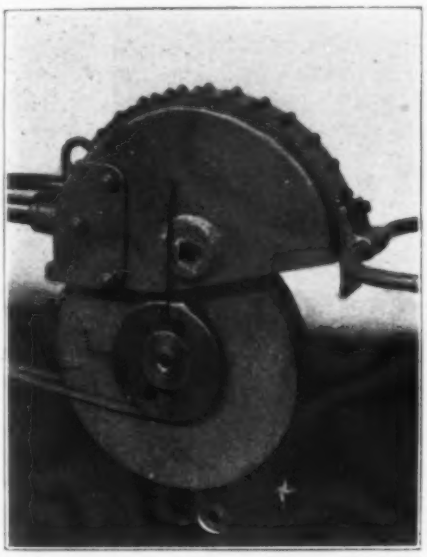
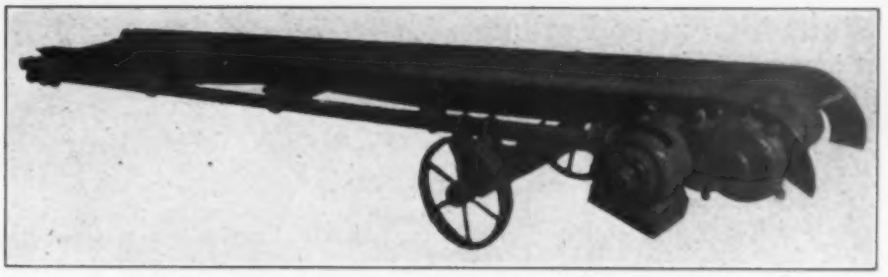


FIG. 1—WHEEL CHANGES ARE MADE BY REMOVING A SINGLE BOLT

wheels are driven by two flexible speed belts, one on either side of the wheel. Heavy duty, barrel type ball bearings are provided in a dust proof assembly within the hole of the wheel.

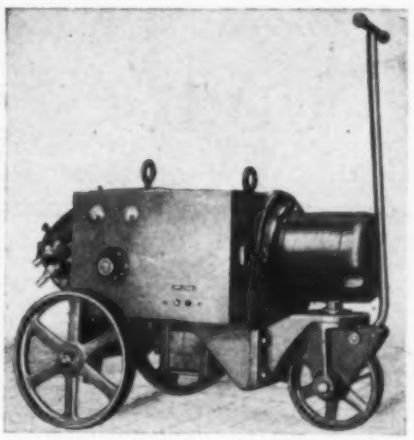
Wheel changes are made simply. A toggle arrangement on the motor releases the V-belts. A single bolt is removed and the wheel head is dropped to the floor. The old wheel then is removed by taking off a combination sheave and flange. The machine may be suspended at the center, with a screw adjustment provided to compensate for loss of weight in the head of the machine due to wheel wear. It also may be fastened to the ceiling with a cable attached at the rear of the machine and with the wheel head supported by a counter-weighted rope running over the pulleys.



THE UNIT IS MOUNTED ON AGRICULTURAL TYPE WHEELS

Introduces Arc Welder

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., recently has introduced a new 200 ampere, single-operator welding set which features simplicity of construction. The



COMPACTNESS IS A FEATURE OF THE ARC WELDER

set is started by connecting directly across the line with a special starter and motor. Starting and stopping are controlled by a push button. A single rheostat varies the arc current over the entire welding range. Accurate adjustment over the welding range, from 60 to 300 amperes, is secured in steps of 5 amperes. The motor generator and control equipment are assembled in a totally enclosed frame. The exciter, which is overhung from the motor end, is fastened securely to the unit frame.

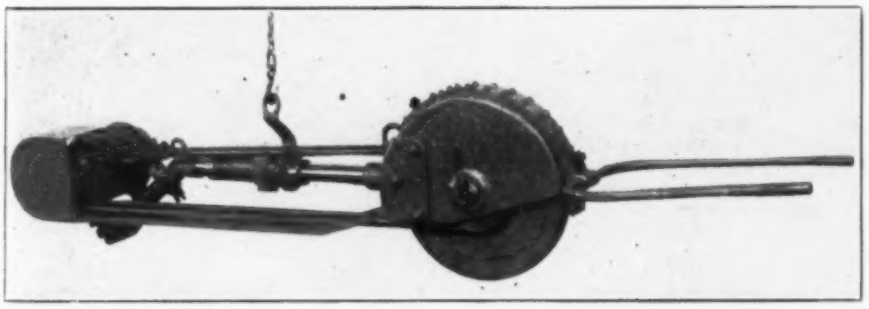


FIG. 2—WHEELS ARE DRIVEN BY TWO BELTS, ONE ON EITHER SIDE OF THE WHEEL

New Portable Conveyor Is Adjustable

The Link-Belt Co., 300 West Pershing road, Chicago, recently has introduced a new portable-type conveyor. The unit, which is light enough for one man to move easily, is mounted on agricultural type wheels 14 inches in diameter and with a 2-inch face. A 12-foot conveyor, complete with motor, weighs 640 pounds, and the 15-foot conveyor, complete with motor, 710 pounds. The wheels are movable at practically any point along the entire frame, which consists of two heavy pipes tied together at head and foot ends by electric steel castings. A pipe handle at the foot end facilitates handling.

A casting at the head end provides a base for the motor and a grease-tight enclosed housing in which the reduction gears operate. All shafts have anti-friction bearings. The height of the discharge point of the conveyor may be adjusted by moving the wheels forward or backward along the conveyor frame. The wheels also are provided with three positions for vertical adjustment.

Celebrates Anniversary

The Box Crane & Hoist Corp., Philadelphia, formerly the Alfred Box & Co., is celebrating its 50th anniversary. The company is one of the pioneer crane builders in America. Booklets recently have been published describing the various types of industrial lifting equipment made by this company which include electric traveling cranes, hand operating traveling cranes, electric hoists from one quarter to fifteen tons capacity, monorail systems, I beam trolley.

E. W. Thomas of A. C. Allyn & Co., investment house, has been made a director of the Foote Bros. Gear & Machine Co., both of Chicago.

Studies Copper Fatigue

Further work in the study of the fatigue of metals recently has been completed at the engineering experiment station, University of Illinois, Urbana, Ill. This work is described in a "Metallographic Study of the Path of Fatigue Failure in Copper," by H. F. Moore and F. C. Howard. The investigators found that specimens of rolled copper subjected to repeated flexure until a fatigue crack developed, showed a surface disturbance of the metal in the vicinity of the crack. This surface disturbance is shown in micrographs of unetched specimens by lines and the crack tends to extend parallel to the lines. The price of the bulletin is 20 cents.

Outlines Methods

An outline of the various methods which are being used to designate the machinability of metals with substantiating data is presented in a bulletin recently published by the department of engineering research, University of Michigan, Ann Arbor, Mich. The bulletin is Reprint Series No. 2 and the price is 50 cents.

To Study Metallurgy

Problems of metallurgy will receive major consideration at the seventh annual industrial gas course to be held at the Massachusetts Institute of Technology, Cambridge, Mass., June 18 to 28 under the auspices of the New England Gas association and the American Gas association. Work of the course will be handled under the same system of rating as ordinarily obtained in the curriculum of the Massachusetts Institute of Technology and a certificate will be awarded at the close of the course. Reservations for the industrial gas course should be made before June 1 through Robert L. Gifford, 231 Main Street, Pawtucket, R. I.

Makes Several Changes

Several changes have been made in the personnel of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. E. C. Brandt and F. J. Shiring have been appointed assistant work managers and J. E. Webster has been made chief plant engineer of the East Pittsburgh works. A. E. Kaiser has been made director of production for all works and S. C. Hoey has been appointed works manager of the Homewood renewal parts works.

Investigates Properties

Properties of Ferrous Metals at Elevated Temperatures is the title of a bulletin by A. E. White and C. L. Clark, published by the department of engineering research, University of Michigan, Ann Arbor, Mich. The bulletin is Reprint Series No. 3 and the price is 50 cents.

W. H. Post has been made manager of the Pittsburgh branch of the Timken Roller Bearing Service & Sales Co., Canton, O. Mr. Post has been connected with the company for several years in the Cleveland office.

What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

Olney Foundry Co., Philadelphia, suffered slight fire damage recently.

Huron Gray Iron Foundry, Ypsilanti, Mich., will soon occupy its new plant now being built at 824 Railroad street.

A new foundry has been built and placed in operation at Garrett, Ind., by W. Ball, Alfred Bahr and J. J. Boring.

V. Bendixen, 2300 Bloomingdale avenue, Chicago, has awarded the contract for a foundry addition 31 x 73 feet.

Appleton Machine Works, Appleton, Wis., C. E. Saecker, president plans to build a 1-story foundry and pattern storage building.

Williams, White & Co., 701 Third avenue, Moline, Ill. F. Ainsworth, manager, plans to build a 1-story foundry addition.

Gillett & Eaton Inc., Lake City, Minn., is building an addition to its foundry to accomodate increasing business.

Fremont Foundry Co., Fremont, O., has awarded the contract for an addition, 80 x 80 feet, to the Steinle-Wolfe Construction Co.

Menomonee Falls Mfg. Co., Menomonee, Wis. manufacturer of bottle washing machinery, suffered damage to its plant in a fire recently.

S. Scullin Foundry, Cambria and American street, Philadelphia contemplates building that part of the foundry which was damaged in a recent fire.

The foundry of the Hiner Supply & Mfg. Co. Raleigh, N. C., was damaged by a fire recently. C. N. Hiner is owner of the company.

Dedman Foundry & Machine Co., Buffalo street, Houston, Tex. has been incorporated with $160,000 capital by H. W. Dedman, C. E. Newton and A. E. Amerman.

Crouse-Hinds Co., Syracuse, N. Y., H. Crouse, manager, plans to build a foundry. Gaggin & Gaggin, 720 University building, are architects.

Stockholders of the American Brake Shoe & Foundry Co., New York, have approved the purchase of a substantial interest in the National Bearing Metals Corp., Pittsburgh.

Cocker Machine & Foundry Co., Gastonia, N. C., is reported contemplating the building of two 1-story additions, 60 x 100 feet and 40 x 60 feet.

Perfection Die Casting Corp., has been incorporated by A. L. Miller, Wilmington, Del., to conduct a general foundry and machine shop business.

Garrison Bronze Corp., 400 East Ohio street, Chicago, has been incorporated with $20,000 capital to operate a foundry, by H. S. Carlsen, W. C. Warren and B. C. Garrison.

Bridgeport Iron Works, W. R. Browne, president, Bridgeport, Pa., has awarded the contract for a 1-story foundry, 95 x 200 feet, to Friend-Reiff Co., Morristown, Pa.

E. L. Freshley, 8714 Quincy avenue, Cleveland, manufacturer of wood and metal patterns, is contemplating moving to larger quarters, and will at that time be in the market for machinery and supplies.

O. E. Szekeley Corp., Holland, Mich has purchased the foundry of the Burke Engineering Co., and has placed the plant in operation. A nonferrous foundry department also has been added.

Real estate of the Bennington Scale Mfg. Co., Bennington, Vt., has been sold under execution. The sale included land, shops and foundry. The equipment of the plant had been disposed of about two years ago.

Charleroi Steel & Foundry Co., Charleroi, Pa., has been reorganized and the plant will be placed in operation soon. Directors are as follows: R. C. Mountser, E. R. Collins, J. K. Tener, D. M. McCloskey and W. C. Haus.

Gunite Corp., Rockford, Ill., has been formed to take over the manufacture of a gun alloy formerly produced by the gunite division of the Rockford Malleable Iron Works. Duncan P. Forbs is president and John A. Forbes secretary and treasurer of the new corporation.

The U. S. Hoffman Machinery Steel Corp., Syracuse, N. Y., will let a contract in the near future for the construction of a new plant. A new foundry will be incorporated in the proposed plant. The company now has a foundry at 715 West Fayete street.

Standard Looms Inc., Spartanburg, S. C., incorporated with $750,000 capital with Isaac Andrews, 519 East Main street, president, plans to build a plant for the manufacture of looms, parts, machinery, etc. The plant will consist of foundry, machine shops and assembling plant.

Waterloo Mfg. Co., Waterloo, Ont., manufacturer of agricultural implements, has been bought by James Playfair, Midland, and E. J. Pallet, Galt, Ont. Plants will be expanded. The company has been in existence for 40 years. It has branches at Portage la Prairie, Regina, Saskatoon and Calgary.

Arcade Malleable Iron Co., Worcester, Mass., has elected officers as follows: President and general manager, Henry P. Blumenauer; vice president, William E. Dunham; treasurer, Robert J. Nelson; directors, John P. Tinsely, J. Verner Critchley, F. A. Drury, Henry P. Blumenauer, William E. Dunham of Worcester; Bowen Tufts, C. E. Stevens, Joseph B. Hoyt, E. L. Bennett, Arnold Whittaker and George A. Ferry of Boston.